



## **1990 - 92 Catalog of Undergraduate Studies**

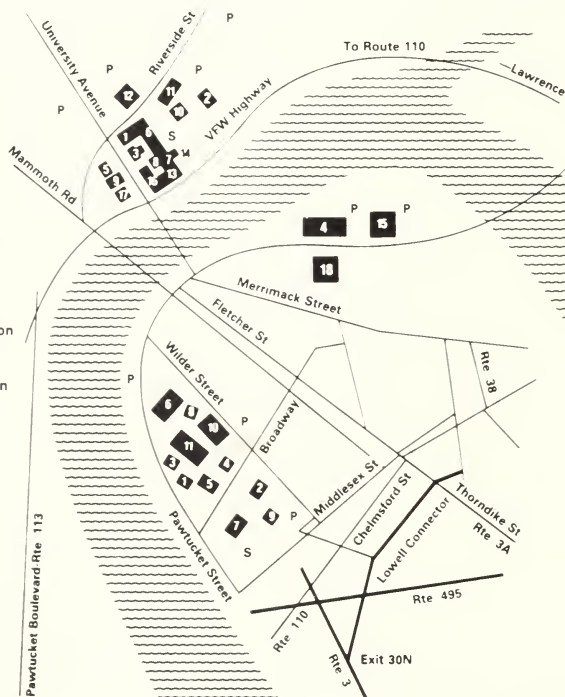
# Map of the University

## North

- 1 Ball Engineering Center
- 2 Costello Gym
- 3 Cumnock Hall
- 4 Dormitories
- 5 Eames Hall
- 6 Engineering
- 7 Falmouth
- 8 Kitson
- 9 Alumni Lydon Library
- 10 Energy Center
- 11 Olney
- 12 Olsen
- 13 Pasteur
- 14 Power Plant
- 15 Research Foundation
- 16 Southwick Hall
- 17 Smith Hall
- 18 Fox Student Union
- P Parking
- S Security

## South

- 1 Allen Hall
- 2 Coburn Hall
- 3 Concordia Hall
- 4 Dining Hall
- 5 Dugan Hall-Admissions
- 6 Durgin Hall
- 7 Mahoney Hall
- 8 O'Leary Library
- 9 Power Plant
- 10 Student Union
- 11 Weed Hall
- P Parking



## TO NORTH CAMPUS

From Route 495

Follow 495 north or south toward Lowell, and take the Lowell Connector. From the Connector take exit 5N. Thorndike St. Bear right off exit ramp, heading north on Thorndike. Follow Thorndike to end (street name changes to Fletcher after it intersects Dutton St.) At the end of Fletcher turn right onto Pawtucket St., then first left onto the Textile Bridge. Across bridge is U Lowell North Campus.

From Route 128

Follow 128 north or south to Burlington area, take Rt. 3 North. On Rt. 3 take exit 30N onto Lowell Connector. From the Connector take exit 5N. Thorndike St. Bear right off exit ramp, heading north on Thorndike. Follow Thorndike to end (street name changes to Fletcher after it intersects Dutton St.) At the end of Fletcher turn right onto Pawtucket St., then first left onto the Textile Bridge. Across bridge is U Lowell North Campus.

## TO SOUTH CAMPUS

From Route 495

Follow 495 north or south toward Lowell, and take the Lowell Connector. From the Connector take exit 5N. Thorndike St. Bear right off exit ramp, heading north on Thorndike. Turn left onto Broadway, and follow to intersection of Broadway and Wilder Streets, at the U Lowell South Campus.

From Route 128

Follow 128 north or south to the Burlington area, take exit 33B to Rt. 3 North. On Rt. 3 take exit 30N onto the Lowell Connector. From the Connector take exit 5N. Thorndike St. Bear right off exit ramp, heading north on Thorndike. Turn left on Broadway, and follow to intersection of Broadway and Wilder Streets, at the U Lowell South Campus.

# A Message from the Director

I am pleased to welcome you to the many programs of the University of Lowell's Division of Continuing Education. With over 62 years of service to adult learners in Massachusetts, New Hampshire and Maine, Continuing Education is the largest of the public institutions in northern New England, with about 25,000 enrollments each year in a variety of educational programs.

As we enter the 1990's, we shall find ourselves in a period of great change in the workplace, the home and also our learning institutions. This will be a decade of restructuring, retraining and repositioning as we prepare for the worldwide challenges of the next century.

Now, more than ever, continuing education organizations in the nation's colleges and universities will assume roles of ever increasing size and importance in satisfying the learning and training needs of our citizenry, our industries and institutions. As the traditional student body decreases in size, the so-called "non-traditional" student becomes a key constituent for any forward thinking university. In short, there will be more and more focus on the needs and goals of the continuing education student. You can expect more access, more choices and more opportunity in the coming years. Indeed this shows in our own programs, with our new Saturday classes, Winter Intersession, a large selection of new courses, expanded counseling services and an exciting array of opportunities in professional development seminars and other special programs.

We invite you to explore the credit course offerings in this catalog. If you have questions about any of our credit and non-credit programs, please feel free to contact our staff. We wish you a pleasant and rewarding experience at the University of Lowell.

E. Yalouris  
Director

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# UNIVERSITY OF LOWELL



COLLEGE OF  
ENGINEERING

DALE ENGINEERING CENTER



# About the University

The University of Lowell was formed in 1975 through a merger of Lowell State College and Lowell Technological Institute. Each of these institutions was established in the 1890's, Lowell State College as a teacher's college and Lowell Technological Institute to prepare students for the textile industry. Lowell State College was chartered in 1894, became a four-year institution in 1932 and, in 1960, added non-teaching programs and a Liberal Arts curriculum. The College granted degrees in education, health professions, liberal arts, sciences and music.

From the time of its origin in 1895 as a proprietary textile school, Lowell Technological Institute provided educational programs of an applied and practical nature. The control of the school was transferred to the state in 1918, and in 1928 it was granted collegiate status. In 1953, it became a multi-purpose technological institute. Prior to its merger with Lowell State College, the Institute phased out its textile curricula; it extended its offerings in engineering, technology, science, business administration and industrial management; and it received authorization to offer doctorate degrees.

The University occupies 35 buildings on three campuses (north, south, and west) and presently has a faculty in excess of 500 and a student enrollment of more than 14,000. It is comprised of six colleges, a graduate school and the Division of Continuing Education, which serves an additional 15,000 students.

## Mission of the University

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The University of Lowell is publicly supported by the Commonwealth of Massachusetts, and offers degree programs at all levels through the doctorate. Although undergraduate program emphasis is in business, engineering, health, music and science; the University strongly believes in the values of a liberal arts education for intellectual development and as a major component of professional preparation. Graduate program emphasis is in areas where there are strong regional needs or where the University possesses superior resources.

The University is committed to the promotion of scholarly research and creative, artistic achievement. Recognizing its role as a public institution, the University is committed to active involvement in community service through instruction, research, consulting, cultural events and the Division of Continuing Education. Finally, the University recognizes its responsibility for implementing the principles of equal opportunity and affirmative action, and ensures that all students and employees are guaranteed the benefits of a just and equitable system.



## Academic Computer Center

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The University academic computer center, located in the Olsen building, provides a wide range of facilities and services in support of classroom teaching and research at both the undergraduate and graduate level. The central computer facility consists of a cluster of two machines: a DEC VAX 6420 and a DEC VAX 8810, both employing the VAX VMS operating system and utilizing many peripherals which include twelve disk storage units, a line printer, two magnetic tape units and a variety of communications equipment. This system primarily supports a vast time-sharing environment with a batch processing option. Access to these resources is available from any area in the University through an ever expanding telecommunications network. The operating system software includes: Assembler Language, APL, BASIC, C, COBOL, FORTRAN, LISP, Pascal, and a library of application packages including SPSSX, TSP, IMSL, MINITAB, SIMSCRIPT, MPOS, SPICE, ACSL, MAXSYMA, etc. These computer facilities are supported by the academic computer center organization with a professional and support staff of eight.

In addition to the central computing facilities supported by the academic computer center, there are several minicomputer systems and several hundred microcomputers installed in various colleges and departments throughout the University. These facilities, which are operated and maintained at the college or department level, include the following: VAX 8650, VAX 8700, VAX 8550, VAX 11/780, 11/750, 11/730, microVAX (five), PDP 11's, Appollo network (40 nodes), Computervision, Data General MV/400 (two), Hewlett Packard-1000, and numerous Zenith, IBM, Apple, DEC and other micros. Most of these systems are either linked or have access to the University-wide telecommunications network.

## University Libraries

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The University libraries, which consist of the Alumni/Lydon Library (North Campus) and the O'Leary Library (South Campus), include over 370,000 books and periodicals and a large number of such non-print materials as video tapes, films and microforms. The O'Leary Library provides resources in the social sciences, humanities and health areas, and houses the ERIC microfiche collection (Educational Resources Information Center). Music collections and facilities of O'Leary Library include listening stations, audio recordings and over 7,000 music scores. The Alumni/Lydon Library houses collections for engineering, science and business.

The Center for Lowell History (in the Boott Mill Complex, downtown Lowell) contains special collections of the University, including the holdings of the American Association of University Women, Greater Lowell Chapter; Boston and Maine Railroad Historical Society; Lowell Historical Society; Lowell Museum; Manning Family; Middlesex Canal Association; Proprietors of the Locks and Canals on the Merrimack River; University Archives; and a collection of regional histories. Other



valuable resources include educational media and New England maps published by the Geological Survey of the U.S. Department of the Interior. The University libraries provide interlibrary loan services and function as a U.S. Government depository.

## **Academic Accreditation and Professional Memberships**

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The University of Lowell is an accredited member of the New England Association of Schools and Colleges. Accreditation indicates that the University is recognized and approved by regional and national associations concerned with the quality of higher education; and it assures that study undertaken here has transfer value to other accredited institutions of higher education.

Professional programs at the baccalaureate level also are accredited by the following national associations:

- Accreditation Board for Engineering and Technology
- American Assembly of Collegiate Schools of Business
- American Physical Therapy Association
- National Accrediting Agency for Clinical Laboratory Sciences
- National Association for Industrial Technology
- National Association of Schools of Music
- National Council for the Accreditation of Teacher Education
- National League for Nursing

The following programs offered through the Division of Continuing Education are accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET):

- Civil Engineering Technology
- Electronic Engineering Technology
- Mechanical Engineering Technology

Additionally, specific programs have been reviewed by the following associations to ensure compliance with applicable professional standards:

- American Chemical Society
- Interstate Certification Compact

The University is also a member of the following associations:

American Association of Colleges for Teacher Education  
American Association of Colleges of Nursing  
American Council on Education  
Association for Continuing Higher Education  
Association for State Colleges and Universities  
College Entrance Examination Board  
Council of Colleges of Arts and Sciences  
National Association of Summer Sessions  
National Association of State Directors of Teacher Education and Certification  
National University Continuing Education Association  
New England Board of Higher Education



# About Continuing Education

The aim of the Division of Continuing Education is to provide a variety of high quality programs for a broad student constituency at the lowest possible tuition. By defining and implementing a mission that is closely integrated with the needs of the students it serves, the Division of Continuing Education at the University of Lowell has established itself as a major force in higher education. The University of Lowell has one of the largest continuing education units in New England.

## History

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The development of the Division of Continuing Education at the University of Lowell parallels the growth of Lowell Technological Institute. Beginning in 1928, courses for textile workers were offered in the afternoon and evenings to teach industrial and commercial applications. In 1953, when Lowell Tech became a multi-purpose technological institute, it offered an evening and summer school to help meet the needs of part-time students and college students seeking to accelerate course work. With the creation of the University of Lowell in 1975, offerings in education, health professions, liberal arts, sciences and music were added to the Lowell Tech offerings.

Currently, the Division of Continuing Education has four distinct service areas: undergraduate degree and certificate programs, non-credit courses in Community Education, Special Programs and Summer Session, during which graduate, undergraduate and non-credit programs are offered.

## Academic Degree Programs

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A primary purpose of the Division of Continuing Education is to provide college credit courses and degree programs to a variety of adult learners. Students enroll in programs to acquire extensive practical background and skills, for professional advancement, to facilitate career changes, and for personal enrichment and satisfaction. University faculty and experienced professionals teach a wide spectrum of credit courses leading to associate's and bachelor's degrees. The Division sets policies and schedules with the working person in mind. Career oriented curricula in many fields are available on a part-time, evening basis.

The Division of Continuing Education attracts people of all ages, cultural and educational backgrounds. The Continuing Education student population includes transfer

students from area community colleges, people returning to school and individuals who work full time in business, government, hospitals, schools and other institutions.

### **College of Arts and Sciences**

#### **Associate's Degree**

- Public Service: Administration of Criminal Justice
- Applied Chemistry
- Applied Mathematics
- Applied Mathematics: Computer Option
- Information Systems

#### **Bachelor's Degree**

- Applied Chemistry
- Applied Chemistry: Coatings Option
- Applied Mathematics
- Applied Mathematics: Computer Option
- Information Systems
- Public Service: Administration of Criminal Justice
- Social Sciences and History
  - Concentrations in History, Political Science, Psychology, Sociology

### **The James B. Francis College of Engineering**

#### **Associate's Degree**

- Civil Engineering Technology
- Electronic Engineering Technology
- Mechanical Engineering Technology

#### **Bachelor's Degree**

- Civil Engineering Technology
- Electronic Engineering Technology
- Mechanical Engineering Technology
- Industrial Technology
  - Manufacturing Option
  - Water and Wastewater Option
  - Plastics Option

### **College of Management Science**

#### **Associate's Degree**

- Management
- Accounting
- Banking

### **Certificate Programs**

- Computer Proficiency
- Industrial Security Management
- Technical Communications



## Community Education Program

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Credit-free courses at the University are among the most diverse and dynamic offerings of the Division of Continuing Education. They were created for adults whose interests range from personal enrichment to professional advancement. Currently, courses are offered in the arts, careers and communicating, finance and real estate, health and fitness, language, sports and recreation, and refresher subjects. The main office of Community Education is located in the new Downtown Center for Continuing Education in the Boott Mill Complex on French Street. In this spacious and modern building, the program will continue to offer the latest adult education courses at affordable prices and at convenient times.

In addition, Community Education sponsors the Learning In Retirement Association, (LIRA), cooperative education for retired and semi-retired people, which is also housed in the Downtown Center. Classes, trips, concerts and lectures are self-taught and reasonably priced, and membership is growing steadily. For further information on Community Education, please call the Division of Continuing Education at (508) 934-2480.

## Summer Session

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The Division of Continuing Education operates a full summer schedule, providing graduate as well as undergraduate courses during evening and day hours. Individuals enroll in the University Summer Session to accelerate their program of study, make up course work, facilitate career promotions or for personal enrichment. Some of the new programs to be offered in the Summer Session include a Theater and Film Institute; a Writing Program; a high school program for gifted high school students interested in science, engineering or the arts; and a residential English as a Second Language Program. These programs offer participants opportunities to meet with award winning professionals in the fields of drama, cinema, engineering, science and the arts.

Registration for any summer session may be made by phone, mail or walk-in procedures. The summer bulletin, which lists the variety of courses and special programs offered, is available by calling the Division of Continuing Education at (508) 934-2480. Summer dormitory housing may be arranged for those who wish to enjoy the full academic and social life that summer at the University of Lowell offers.

## Special Programs

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The Office of Special Programs manages over 150 professional seminars and conferences annually. These programs range from small, single-session seminars to large academic conferences featuring regional and national topics. Most seminars are taught by University faculty and highlight their research and academic specialties. Among the facilities available at the University are classrooms, state of the art laboratories, concert and lecture halls, athletic complexes and the Downtown Center for Continuing Education.

This latest facility offers a convenient downtown location with comfortable meeting rooms and exhibit space for poster sessions. Additionally, some dormitory housing is offered to participants in summer programs as a low-cost alternative to local hotels. These facilities offer convenient accommodations and meal service.



# Course Notation System

Each course offered by the Division of Continuing Education is designated by a two-digit prefix and a three-digit course number. The two-digit college prefix identifies the college department. The three-digit course number identifies the course level.

## Course Prefixes

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### College of Arts and Sciences

40	American Studies
42	English
43	History
44	Criminal Justice
45	Philosophy
46	Political Science
47	Psychology
48	Sociology
57, 58	Art
50, 51, 52, 54	Languages
59	Intercollegiate Liberal Arts
68	Economics
81, 83	Biology
90, 92	Mathematics
90, 92	Computer Mathematics Option
84, 86	Chemistry
87, 89, 93	Environmental Sciences
99	Physics

### The James B. Francis College of Engineering

15	Civil Engineering Technology
17	Electronic Engineering Technology
19	Work Environment
23	Mechanical Engineering Technology
20	Industrial Technology
	Manufacturing Option
	Water/Wastewater Option
27	Industrial Technology
	Plastics Option



## College of Management Science

67	Accounting
69	Banking
69	Management

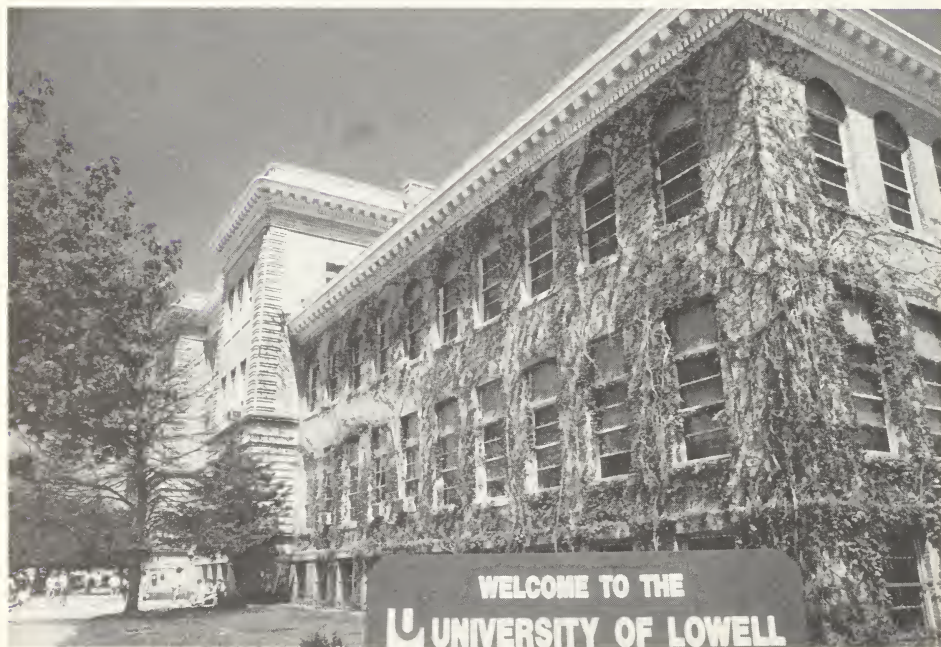
## College of Music

71	Music
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## Course Numbers

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- 001-099: pre-freshman and special undergraduate courses and do not carry baccalaureate degree credit
- 100-299: lower division undergraduate courses
- 300-499: upper division undergraduate courses
- 500-599: graduate courses open to upper division undergraduates with the consent of instructors and chairpersons
- 600-699: for graduate students only





# Course Descriptions

## Accounting

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### **67.101 Accounting Principles I**

Presents a comprehensive and detailed exposure to basic accounting theory. Beginning with the accounting equation, the student is introduced to the accounting cycle, preparation of the Statement of Financial Position and the Income Statement. Accounting for the assets of a firm will also be discussed. 3 credits.

### **67.102 Accounting Principles II**

Emphasizes accounting for corporations, treatment of stockholders' equity, earnings and dividends. Students will examine the Statement of Changes in Financial Position, cash flow causes and effects, as well as financial statement analysis. 3 credits. Prerequisite: 67.101.

### **67.203 Intermediate Accounting I**

Examines the generally accepted accounting principles relating to the preparation of financial statements. The student will study the valuation and disclosure problems associated with the assets of the firm. 3 credits. Prerequisite: 67.102.

### **67.204 Intermediate Accounting II**

Continues the in-depth study of the valuation and disclosure problems associated with corporate liabilities and stockholders' equity. Emphasis is placed on the opinions of the Accounting Principles Board and Financial Accounting Standard Board. 3 credits. Prerequisite: 67.203.

### **67.205 Advanced Financial Accounting**

Explores theoretical and practical problems in accounting for large, multicorporation business entities. Consolidation, mergers and home office/branch accounting each receive in-depth study. 3 credits. Prerequisite: 67.204.

### **67.206 Cost Accounting**

Examines the manufacturing function from the view of the cost accountant. Managerial control of the elements of product costs will be studied with an emphasis on cost accumulation systems both historical and estimated. 3 credits. Prerequisite: 67.102.

### **67.207 Auditing**

Examines the purposes of financial auditing and operations auditing. The following topics will be discussed in detail: auditing, standards, professional ethics, legal responsibilities, internal control, audit evidence, financial statements, disclosures, audit reports, management advisory services, and internal auditing. 3 credits. Prerequisite: 67.204.

### **67.209 Federal Income Taxes**

Deals with the basic rules and regulations of the Internal Revenue Code as it affects the individual and the corporation. An understanding of the code is developed through lectures, assigned readings and research. Upon completing this course, students will be able to find solutions to a wide variety of tax problems. 3 credits. Prerequisite: 67.102.

## American Studies

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### **40.222 Women in American Culture**

Examines the unique obstacles and opportunities that have been faced by women in American culture. The areas of politics, religion, literature, art, entertainment, business and anthropology will be discussed. Both men and women are welcome. 3 credits.

### **40.247 American Business Culture**

Examines the impact of the unique values and beliefs found in American culture on the development of American business. 3 credits.

## Art

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### **57.251 Visual Design I Studio**

Studies design principles and how they articulate structure, space and form. The development of visual ideas that relate to painting, sculpture, graphic arts and architecture will also be covered. 3 credits. Area II core course except for students in the College of Engineering.

### **57.255 Drawing I Studio**

Provides a foundation in basic concepts and techniques using a variety of drawing media. The emphasis is on realism and its application to the realm of ideas. A wide range of assignments are given to develop graphic expression. 3 credits. Area II core course except for students in the College of Engineering.

### **57.271 Painting I Studio**

Presents oil painting techniques as vehicles for serious creative expression. A variety of assignments will be given to help the student gain proficiency in the use of color technique and subject matter. 3 credits.

### **57.297 Studio Workshop**

Presents a study of studio problems in visual structures and organization, as well as an exploration of various media and techniques. Topics will vary. This course may be repeated. 3 credits.

### **58.101 Appreciation of the Visual Arts**

Helps students to develop an appreciation of the visual elements used in art such as color, line and shape. Emphasis is placed on modes of representation, styles, media, technical procedures and principles of design. 3 credits. Area II core course.

### **58.203 Survey of Art I**

Surveys the major Western arts from earliest time to the Middle Ages presented chronologically. Emphasis is placed on the changing nature of style and content within sequential cultural contexts. The aim of the course is to introduce the student to basic critical and art historical methods. 3 credits. Area II core course.

### **58.204 Survey of Art II**

Surveys the major Western arts from the Renaissance to the 20th century presented chronologically. Emphasis is placed on the changing nature of style and content within sequential cultural contexts. The aim of the course is to introduce the student to basic critical and art historical methods. 3 credits. Area II core course.

### **58.231 Greek and Roman Art**

Studies Greek painting, sculpture and architecture from the Cycladic to the Hellenistic period. An examination of Roman Art from the Etruscan age to the beginning of Christian art is also presented. Emphasis is placed on the art of the Greek classical period and the Roman Empire. 3 credits.

## **Banking**

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Banking courses are not eligible as Accounting or Management (Business) electives.

### **69.101 Principles of Banking**

Fulfills the same role as the **Principles of Bank Operations** course it replaces; however, it provides an updated and broader perspective of the banking industry. This course touches on nearly every aspect of bank functions, including a comprehensive introduction to banking in today's economy. Discussions on specific topics are presented in an easily accessible form. The language and documents of banking, check processing, teller functions, deposit function, trust services, bank bookkeeping and bank loans and investments are some primary topics. The course ends with a discussion of the bank's role in the community. 3 credits.

### **69.104 Analyzing Financial Statements**

Provides students with tools and techniques needed for the evaluation of financial condition and operating performance of a modern business enterprise. The course is divided into four parts: Financial Statement Analysis and Accounting, Financial Statements and Business Funds Flow, Tools of Finan-

cial Statements Analysis, and the Technique of Financial Statement Analysis. 3 credits. Prerequisite: 67.102.

### **69.105 Consumer Lending**

Emphasizes the pragmatic "how-to" details of installment credit. Topics include: principles of credit evaluation, open-end credit, marketing bank services, collection policies and procedures, legal aspects, financial statement analysis, direct and indirect installment lending, leasing and other special situations, installment credit department management, insurance rate structure, and yields. 3 credits.

### **69.106 Real Estate Finance**

Provides a background in the varied real estate mortgage credit operations of commercial banks. This course treats the main areas of real estate by concentrating on the following broad areas: 1) the manner in which funds are channeled into the mortgage markets; 2) the financing of residential property; 3) the financing of special purpose property; and 4) the administrative tasks common to mortgage departments. 3 credits.

### **69.107 Bank Investments**

Explains the nature of the more important bank investments and demonstrates the relationship of investment management to other functional areas of the bank. This course also discusses the factors that affect investment strategies and decisions. Emphasis throughout is on the fundamental principles with which investment personnel should be familiar: the nature of risk, liquidity and yield; how each is measured; and how they are related. 3 credits. Prerequisite: 69.101.

### **69.109 Marketing for Bankers**

Presents marketing as a broad concept. The course deals with concepts and philosophies of marketing including: information, research and target, the marketing mix (product strategy, distribution strategy, advertising and sales promotions, personal selling, pricing strategy), and the methods of market planning. 3 credits.

### **69.114 Retail Banking**

Staff leader, financial expert, sales manager ... today's successful bank manager needs to be all these and more. The Retail Banking Series shows you how to perform each of these roles more effectively using accepted management principles in the banking environment. The series consists of three separate mini-courses tailored to those managing or preparing to manage human and financial resources in today's fast-paced banking world. The courses are Retail Management, Sales Management, and Financial Performance of Banks. 3 credits.

### **69.116 Commercial Bank Management**

Provides a complete introduction to the handling of day-to-day bank activities. Examples include: the formulation of objectives and policies; the management of assets and liabilities; the sources and uses of funds; the administration of deposits; loans and other investments; and the short-term management of funds. This class also incorporates case studies to aid the student in acquiring bank management skills. 3 credits. Prerequisite: 69.101.

### **69.117 Law and Banking: Principles**

Serves as a banker's guide to law and legal issues with special emphasis on the Uniform Commercial Code. This course includes up-to-date summaries of law pertaining to contracts, real estate and bankruptcy. It also contains a complete chapter on the legal implications of consumer lending. A comprehensive glossary of legal terminology related to banking and commercial transactions is included. 3 credits.

### **69.118 Law and Banking: Applications**

Provides an introduction to the laws pertaining to secured transactions, letters of credit and the bank collection process. This course also discusses check losses and a broad range of legal issues related to processing checks. The material on secured transactions contains up-to-date summaries of the laws related to collateral, perfection and default. Interesting case studies are used to illustrate important legal points related to banking practices. 3 credits. Prerequisite: 69.117.



### **69.119 Commercial Lending**

Provides entry-level commercial loan officers with the knowledge and skills to service the vital needs of corporate clients. The course emphasizes: organization of commercial lending operations, role of commercial lending in bank profitability, loan interviewing and credit investigation, loan documentation, administration, and closing, and preventing and resolving problem loans. 3 credits. Prerequisite: 67.102.

## **Biological Sciences**

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### **83.101 Life Science I**

Provides an introduction to the study of biology which considers first the chemical basis of life and then the Earth's environment as a community in which plants and animals live, interact and demonstrate genetic variations that enable them to adapt to changes and evolve. 3 credits. Corequisite: 83.103. Area III Science lecture core course.

### **83.102 Life Science II**

Emphasizes systems structure and function. The cellular organization of plants and animals will lead into physiological processes of higher organisms including nutrition and digestion, cellular metabolism, circulatory, respiratory, excretory, nervous, reproductive and musculo-skeletal systems. Hormonal control and immunity will be considered. Among the topics covered are chemistry relating to life processes, genetics which covers human inheritance as well as DNA replications, transcription and mutagenesis. Behavior, evolution and ecology will also be discussed. 3 credits. Corequisite: 83.104. Area III Science lecture core course.

### **83.103 Life Science Laboratory I**

Involves laboratory work associated with 83.101. 1 credit. Corequisite: 83.101. Must be taken with 83.101 for Laboratory Science Area III lab requirement.

### **83.104 Life Science Laboratory II**

Involves laboratory work associated with 83.102. 1 credit. Corequisite: 83.102. Must be taken with 83.102 for Laboratory Science Area III lab requirement.



## **84.111 General Chemistry**

Offers a one-semester survey of the principles of inorganic chemistry. The structure of matter, the quantitative aspects of chemical reactions, solution chemistry, including acid-base chemistry and ionic equilibria will all be discussed. 3 credits. Corequisite: 84.113.

## **84.113 General Chemistry Laboratory**

Serves as the laboratory course corequisite with 84.111 with experiments designed to cover the structure of matter, the quantitative aspects of chemical reactions and solution chemistry, including acid-base chemistry and ionic equilibria. 1 credit. Corequisite: 84.111.

## **84.121 Chemistry I**

Provides an introduction to the basic concepts of chemistry through classroom discussions and demonstrations. Topics include chemical calculations, atomic structures, the periodic table, basic bonding theory, solutions, liquids and gases. 3 credits.

## **84.122 Chemistry II**

Serves as a continuation of 84.121. Topics include thermodynamics; kinetics, acids and bases; an introduction to organic chemistry; chemical equilibrium; precipitation reactions; and electrochemistry. 3 credits. Prerequisite: 84.121.

## **84.223 Principles of Organic Chemistry I**

Discusses structure, classification by functionality, nomenclature, synthesis and reactions as well as mechanisms of reactions of organic compounds. 3 credits. Prerequisite: 84.122. Corequisite: 84.225 or permission of Coordinator.

## **84.224 Principles of Organic Chemistry II**

Serves as a continuation of 84.223. 3 credits. Prerequisite: 84.223. Corequisite: 84.226 or permission of Coordinator.

## **84.225 Principles of Organic Chemistry Laboratory I**

Laboratory work in this course is scheduled to accompany topic presentations in the lecture (84.223) and will be devoted to product separation and purification techniques, methods of synthesis of important compounds and instrumental analytical techniques. 1 credit. Corequisite: 84.223.

## **84.226 Principles of Organic Chemistry Laboratory II**

Serves as a continuation of 84.225. 1 credit. Prerequisite: 84.225. Corequisite: 84.224.

## **84.314 Analytical Chemistry II**

Introduces modern instrumental methods of chemical analysis. Topics to be discussed include ultraviolet, infrared nuclear magnetic resonance, emission and atomic absorption spectroscopy. Mass spectrometry, chromatography, thermal and electrochemical methods of analysis will also be covered. 3 credits. Prerequisites: 86.122, 99.133. Corequisite: 84.316.

**84.316 Analytical Chemistry  
Laboratory II**

Presents laboratory experiments designed to complement the coverage of topics in 84.314. 2 credits. Prerequisite: 86.122. Corequisite: 84.314.

**84.334 Advanced Inorganic  
Chemistry**

Introduces modern theories of atomic structure and chemical bonding with emphasis on physical chemical principles and properties. Considerable time will be spent on coordination compounds including topics such as descriptive chemistry, biochemical importance and ligand field theory. 3 credits. Prerequisite: 84.345.

**84.344 Physical Chemistry I**

Covers basic physical chemical topics: laws of thermodynamics, solutions, chemical and phase equilibria, electrochemistry, kinetics, atomic and molecular structure. 3 credits. Prerequisites: 86.122, 92.126, 99.133. Corequisite: 86.355.

**84.345 Physical Chemistry II**

Refer to the description under 84.344. 3 credits. Prerequisite: 84.344. Corequisite: 84.347.

**84.347 Physical Chemistry  
Laboratory II**

Laboratory work designed to exemplify the principles of chemical kinetics, equilibrium and spectroscopy. 1 credit. Corequisite: 84.345.

**86.121 Analytical Chemistry A**

Discusses the principles and calculations of gravimetric and volumetric analysis. Material is presented in class and laboratory format. 3 credits. Prerequisites: 84.122, 92.115.

**86.122 Analytical Chemistry B**

Presents advanced concepts in wet methods of analysis in classroom and laboratory format. 3 credits. Prerequisite: 86.121.

**86.352 Chemical Applications**

Provides a study of the chemical principles applied to one or more areas of industrial technology. 3 credits. Prerequisite: 84.345.

**86.355 Experimental Physical  
Chemistry**

Laboratory work designed to exemplify the principles covered in 84.344. 1 credit. Corequisite: 84.344.

**86.361 Advanced Organic  
Chemistry I**

Provides in-depth coverage of properties and reactions of organic compounds stressing such aspects as synthetic methods and reaction mechanisms. 3 credits. Prerequisites: 84.224, 84.345.

**86.362 Advanced Organic  
Chemistry II**

Serves as a continuation of advanced level study of organic compounds stressing synthesis and reaction mechanisms. 3 credits. Prerequisite: 86.361.

**86.421 Special Topics in Chemistry**

Offers an in-depth treatment of one or more areas of advanced chemistry or industrial applications of chemistry. Students enrolling in the course must have the permission of the Chemistry Coordinator. 3 credits.

**86.471 Industrial Chemistry**

Discusses essential chemical principles in selected areas of industrial concern, including the effect of industrial processes on the environment. 3 credits. Prerequisites: 84.224, 84.345.

### **86.481 Chemistry of High Polymers I**

Discusses the physical and organic chemistry of monomers and polymers, including a consideration on non-bonding forces, spectroscopic methods of structure determination, fractionation and thermodynamics. 3 credits. Prerequisites: 84.224, 84.345.

### **86.482 Chemistry of High Polymers II**

Serves as a continuation of 86.481. Topics presented will include methods of molecular weight determinations for polymers in solution; kinetics of condensation and addition polymerization; and mechanisms of free radical and ionic polymerization. 3 credits. Prerequisite: 86.481.

## **Civil Engineering Technology**

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### **15.113 CAD**

Demonstrates CAD concepts using both class discussion and laboratory work. Using interactive computer graphics workstations, students will create two civil/architectural drawings that involve the processes of inserting and modifying lines, arcs, text, dimensions and other geometric entities. 2 credits. Prerequisite: 23.101.

### **15.123 Surveying I**

Presents principles of data gathering using surveying processes in both classroom discussions and laboratory exercises. Theories and methods of instrumental techniques for measurement of length, directions, coordinates, areas, volumes and topographic data will be presented. An introduction to and use of electronic distance measuring equipment is also included. Problems are used to illustrate processing of field work data. Illustrative fieldwork projects give students facility in basic surveying techniques. One session per week and five Saturdays of fieldwork. 4 credits. Prerequisites: 92.115, 23.101.

### **15.124 Surveying II**

Serves as a continuation of 15.123. Application of basic surveying techniques, in class and lab, of engineering problems implicit in transportation engineering; industrial and domestic housing; utilities for the safety and convenience of humans; use of land resources; and the supply and control of water will each be presented. Fieldwork projects will be typical of the applications of surveying to engineering. One session per week and five Saturdays of fieldwork. 4 credits. Prerequisite: 15.123.

### **15.224 Material/Structural Laboratory**

Provides an experimental study of construction materials such as steel, concrete, etc. and the properties of soil. Material will also include flexure test of beam and load test of truss. 1 credit. Prerequisites: 15.251, 15.253, 15.254.

### **15.237 Statics**

Discusses the fundamentals of statics, including such topics as force systems, resultants, equilibrium, friction, first moments of masses and areas. 3 credits. Prerequisites: 92.125, 99.131. Corequisite: 92.126



**15.238 Dynamics**

Presents the laws of kinematics of particles and rigid bodies involving absolute and relative motion. Newton's law as applied to the kinetics of rigid bodies in motion will be discussed. Principles of work and energy, impulse and momentum are also covered. 3 credits. Prerequisite: 15.237.

**15.239 Strength of Materials**

Discusses principles of strength of materials, centric, torsional and flexural loading, principle stresses, Mohr's stress cycle strain, temperature effects, shear and moment diagrams. 3 credits. Prerequisite: 15.237.

**15.242 Steel Design I**

Covers the selection and proportioning of structural steel members to resist axial, shearing, bending and combined stresses. The design of simple riveted, bolted and welded connections will be covered. Use of current AISC Specifications and Commentary is also presented. 3 credits. Prerequisite: 15.251.

**15.246 Introduction to Hydraulics**

Presents the properties of fluids, principles of hydrostatic pressure, fluid flow with applications to orifices, tubes, weirs, and pipes. Two demonstration laboratory sessions will be held during the semester. 3 credits. Prerequisite: 15.237.

**15.247 Hydraulics Laboratory**

Presents the fundamentals of measurements in the general area of hydraulics. Laboratory topics include friction losses in pipes and valves, flow through venturi and orifice, hydraulic ram, study of open channel flow, etc. 1 credit. Prerequisite: 15.246.

**15.251 Structural Analysis I**

Provides an analysis of statically determinate structures. Topics to be covered include: reactions and stresses; framed structures, beams, trusses, graphic statics, roof trusses, truss and girder bridges; long span bridges; and lateral bracing and portals. Solution of trusses and frames by a general purpose structural analysis computer program is also presented. 3 credits. Prerequisite: 15.239. Corequisite: 15.253

**15.253 Reinforced Concrete I**

Covers the selection and design of reinforced concrete members to resist axial, shearing, bending and combined stresses by the Working Stress Design method and the Strength method. Design of rectangular beams, T-beams, and slabs will also be discussed. Use of current ACI Specification and Commentary is also covered. 3 credits. Prerequisite: 15.239. Corequisite: 15.251.

**15.254 Soil Mechanics I**

Provides an elementary treatment of the physical properties of soils such as bearing and shearing strengths, soil moisture content, compressibility, consolidation and settlement. The applications of such soil properties to typical foundations including: piles, caissons, and spread footings will also be discussed. 3 credits. Prerequisite: 15.239.

**15.256 Water and Wastewater Laboratory**

Presents an experimental study of the chemistry of water and wastewater which includes basic laboratory techniques and procedures, water chemistry, turbidity, odor PH, taste and hardness, alkalinity, jar testing, BOD, COD, etc. 1 credit. Prerequisite: 15.356.

**15.257 Highway Elements**

Provides an integral presentation of the broad field of basic highway principles including highway administration, economics and finance, planning, design, soils, drainage, earthwork operations, pavement, surface types, cements and highway maintenance. 3 credits.

Prerequisite: 15.124.

**15.352 Structural Analysis II**

Serves as a continuation of 15.251. Deflection calculations for beams, trusses and frames are presented. Analysis of trusses, beams and frames by energy methods and moment distribution will also be covered. The solution of trusses and frames by a general purpose structural analysis computer program is addressed. 3 credits. Prerequisite: 15.251.

**15.356 Environmental Technology**

Covers the chemistry and biology of water and wastewater, design of water treatment process, design of pipe and stream pollution. 3 credits. Prerequisites: 84.111, 15.246.

**15.383 Steel Design II**

Serves as a continuation of 15.242. Design of beam-columns, moment-resisting connections, built-up plate girders, and composite beam and slab sections are covered. Consideration of basic structural members as elements within frame and floor systems are also discussed. 3 credits. Prerequisite: 15.242.

**15.391 Reinforced Concrete II**

Serves as a continuation of 15.253. The analysis of and design for the behavior of the basic concrete members on structural frames and floor systems is discussed. Using design curves and graphs as an aid to the solution of practical problems is also presented. 3 credits. Prerequisite: 15.253.

**15.392 Soil Mechanics II**

Serves as a continuation of 15.254 with emphasis on application of principles. The use of field and laboratory tests in the design of foundation and the treatment of embankments is also covered. 3 credits. Prerequisite: 15.254.

**15.394 Soil Mechanics Lab**

Presents common soil laboratory tests including soil classification graduate, atterberg limits, strength and compressibility tests. 1 credit. Prerequisite: 15.254.

**15.463 Construction Technology**

Presents a descriptive and analytical study of methods and equipment used in the planning and execution of construction projects; as well as the critical path method of scheduling. 3 credits. Prerequisite: 15.257.

**15.470 Project Management**

Promotes the development of management skills and techniques needed to plan, schedule, supervise and control projects. Project estimating; labor cost and productivity, specifications and contracts; time, cost and quality control; and project decision-making and financing are covered. 3 credits. Prerequisite: 15.463.

**15.486 Transportation Elements**

Serves as a continuation of 15.257, presenting selected topics in the field of transportation such as traffic, integrated public transportation, planning and developmental impact of transportation routes. 3 credits. Prerequisite: 15.257.

### **15.495 Civil Engineering Technology Elective**

Presents advanced topics from the sub-disciplines of Civil Engineering Technology; that is, structures, transportation, sanitary technology or soil mechanics. Offered at student request and conditional on sufficient enrollment. 3 credits. Prerequisite: Completion of the required courses in the sub-discipline in which the course is offered.

## **Computer Mathematics**

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Students registering for programming courses may be required to spend non-class time at the University's Computer Center.

### **90.370 Application Software Production Lifecycles**

Examines the key elements involved in introducing a new computer application product and marketing's role in the management of the product lifecycle. The important elements of product introduction are presented. These include market analysis, business plan, sales strategy guide, merchandising program (announcement plan, product briefs, advertising, etc) and follow up support considerations. The importance of marketing's interface to the product development organization is also examined. A case study illustrating these key concepts is included. 3 credits. Prerequisites: two high level programming languages and 42.224 or 42.226.

### **90.457 Computer Security**

Offers an introduction to computer information security. Topics include justification of the need for security and definition of the common threats and vulnerabilities through government legislation and security requirements, risk analysis, security awareness programs, physical and system security, data encryption, understanding viruses and other types of malicious codes, and communications security. The course ends with a project involving performing a security audit and producing a computer security policy. 3 credits. Prerequisite: Junior status.

### **92.202 Microcomputers and Applications Software**

Provides an introduction to the processing of information by microcomputers. Topics include computer logic, memory and input/output. Use of applications software including 1) spreadsheets, 2) word processors, 3) graphics and, 4) databases will also be covered. 3 credits.

### **92.209 Introduction to BASIC**

Presents an introduction to the processing of information by computers. Computer logic, memory, inputs and outputs, timesharing, flow-charting techniques and programming in the BASIC language will be covered. This course is for students with no prior programming experience. 3 credits. Prerequisite: 90.111 or equivalent. Credit given for only one of 92.209 or 92.219.

### **92.219 BASIC Programming**

Covers programming in BASIC, including nested loops, subscripted variables, string manipulation, subroutines and advanced programming techniques. 3 credits. Prerequisite: 90.111 and working knowledge of another programming language. Credit given for only one of 92.209 or 92.219.

### **92.263 FORTRAN Programming**

Covers the programming principles of FORTRAN including input-output, arithmetic and control statements, arrays, functions and subroutines. Structures programming will be emphasized. Students will process several problems. 3 credits. Prerequisites: 90.112 or 92.121.

### **92.265 Pascal Programming**

Serves as an introduction to computer programming using the Pascal language. Topics to be discussed include the elements of algorithm design and data structures; algorithm development by step-wise refinement; language control structures, functions and procedures; the standard data types; scalar data types; and an introduction to structured types. Students will process a number of programs on the University computer. 3 credits. Prerequisite: 92.263. Area III core course.

### **92.267 C Programming**

Introduces students to the techniques of programming in C. The language syntax, semantics, its applications and the portable library are covered. 3 credits.

### **92.268 C++ Programming**

Provides an introduction to the programming principles of C++ including pointers, file I/O, operator overloading and classes. These concepts will be applied to simple data structures such as lists and trees. Object oriented programming techniques will also be emphasized. 3 credits. Prerequisite: 92.267.

### **92.360 Introduction to Data Structures**

Presents the basic concepts of data, linear lists, strings, arrays and orthogonal lists. Trees and graphs, storage systems and structures, storage allocation and collection, multilined structures, symbol tables, as well as searching and sorting (ordering) techniques will all be covered. 3 credits. Prerequisites: 92.265, 92.321, (92.364 strongly recommended).

### **92.363 SPSS-X (Introduction to Data Analysis)**

Deals with the computer analysis of data derived from research in the social, behavioral and life sciences. Topics include data presentation, organization and coding; developing SPSS-X input deck with various control and procedure cards; generating SPSS-X files; data modification, recoding and transformation of data; file manipulation, producing input/output files, deleting, retaining, adding variables, etc.; and statistical procedures, from descriptive to multi-variate statistics. Data sets, including completed questionnaires, will be issued to students for practice in working with the SPSS-X system and performing various functions. 3 credits.



**92.364 Problem Solving with Pascal**

Intended as a practical problem-solving course, to give students further exposure to the topics covered in 92.265 and to provide the tools needed for software development. The course emphasizes these aspects of the programming problem-solving process: problem specification and organization; algorithms, coding, debugging; the elements of good programming style; and the means of producing a high-quality finished product. Programming examples are chosen to span a wide range of both numeric and non-numeric applications. 3 credits. Prerequisite: 92.265.

**92.365 COBOL Programming I**

Presents the programming principles of COBOL, the Common Business Oriented Language. Identification, environment, data and procedures divisions, introduction to compilation procedures and diagnostic processing will be covered. Programming of basic applications, such as inventory and accounting problems is also discussed. 3 credits. Prerequisite: 92.209 or 92.219.

**92.366 Problem Solving with FORTRAN**

Covers advanced FORTRAN programming techniques including multi-dimensional arrays, all FORTRAN data types, character data, file manipulations, advanced subprogram argument passing and multi-dimensional array addressing. Additional topics include testing and debugging, numerical operating system and implementation of algorithms. 3 credits. Prerequisite: 92.263.

**92.368 COBOL Programming II**

Serves as a continuation of 92.365. Advanced programming problems in COBOL, discussion of COBOL systems software, sophisticated routines and generalized business file manipulation will all be presented. 3 credits. Prerequisite: 92.365.

**92.455 Assembly Language Programming I**

Presents absolute machine language coding and the symbolic programming language. The coding of practice problems on a high-speed digital computer using the basic computer instructions including arithmetic, input-out, logic, control operations and data manipulation will be covered. 3 credits. Prerequisites: 92.263 or 92.265.

**92.457 ADA**

Introduces the syntax and semantics of the programming language ADA, including data structures and types, control structures, tasks, packages and generics. Practical exercises involving the language will be included. 3 credits. Prerequisite: 92.265.

**92.461 Systems Simulation and Modeling**

Presents procedures in model construction and computerized simulation, modeling tools and techniques, model conceptualization and implementation, and selected applications of simulation. 3 credits. Prerequisites: 92.263 or 92.265, 92.183.

**92.462 Systems Programming**

Covers basic concepts of assembly programs and compilers, macro-generators, utility programs, supervisions, monitors, and high-level languages. 3 credits. Prerequisites: 92.265, 92.360.

### **92.463 Systems Design and Development I**

Presents a general study of the design and development of computer-oriented data processing systems including: the approach requirements of the system, developing the solution, data controls, system controls, system evaluation, and reporting to management. 3 credits.

### **92.464 Systems Design and Development II**

Continues 92.463. Topics include: finalizing and implementing the system, post-installation evaluation, interdepartmental coordination, and case studies. 3 credits. Prerequisite: 92.463.

### **92.467 Assembly Language Programming II**

Serves as a continuation of 92.455. Symbolic programming using advanced techniques including macro instructions, indirect addressing, file generation and processing. magnetic tape and magnetic disc applications are presented. 3 credits. Prerequisite: 92.455.

### **92.468 Microcomputer Principles and Applications**

Discusses current microcomputer practices for both hardware and software including basic microcomputer instruction sets, operating systems, assembler and I/O programming, utilities, interrupts and interfaces. Scientific, industrial and business applications are studied. 3 credits. Prerequisite: 92.265.

### **92.469 Compiler Construction Techniques**

Studies typical compiler organization including symbol tables, various types of scans, object code generation, error diagnostics and optimization techniques. Segments of a classroom compiler are written by students. 3 credits. Prerequisite: 92.462.

### **92.470 Data Communications**

Covers data transmission, media, data encoding, digital data communication techniques, data link control, modems, PC communications software, multiplexing, communication networking techniques, and an introduction to local area networks. 3 credits. Prerequisites: 92.265, 92.360.

### **92.472 Data Communications Protocols**

Discusses local area network technology, protocols for local area networks, digital PBX concepts, internetworking concepts and protocols, and network management. Emphasis on emerging standard protocols, standard protocols and widely used proprietary protocols. 3 credits. Prerequisite: 92.470.

### **92.474 Data Base Concepts**

Introduces data base directives, design element of 3 data bases, architectures, and commercial data bases. Students will participate in design of a large-scale data base application and administration of this data base. Students will also program the basic concepts on a machine. 3 credits. Prerequisites: 2 semesters of higher level language, excluding BASIC.

### **92.476 Computer Organization**

Presents the computer architecture knowledge the software engineer needs. Students are introduced to the representation of information and the concepts of gates and elementary logic. Storage mechanisms and memory organizations are described and a functional layout of an elementary computer is given. Addressing methods are explained and various methods of I/O are discussed. Microprocessors, large computers, parallelism, and distributed logic are also covered. 3 credits. Prerequisites: 92.265, 92.455.

### **92.477 Information Systems I**

Serves as an introduction to Management Information Systems (MIS), emphasizing information needs at various management levels, including problem finding as well as problem solving. The course highlights the use of real time, distributed data processing, decision support and expert systems in the decision-making process of today's business. The student will understand how the use of different hardware and software can answer a wide range of "what if" questions, crucial in today's planning function. 3 credits. Prerequisite: Junior status.

### **92.478 Information Systems II**

Continues 92.477, stressing the systems approach of MIS, focusing on methodologies used and the control over MIS as it relates to other business areas. Case studies are used to unify preceding topics as they relate to corporate planning, marketing, manufacturing, accounting, finance and personnel subsystems. 3 credits. Prerequisite: 92.478

## **Criminal Justice**

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### **44.101 The Criminal Justice System**

Presents a brief history of the criminal justice system and an analysis of its structure and function. Required for all Criminal Justice majors and prerequisite to all courses in Criminal Justice. 3 credits.

### **44.111 Introduction to Industrial Security**

Serves as an introduction to the planning, organization and management of industrial, business and government security resources, including the systems approach to security operations. This course focuses on the protection of assets via the integration of physical, personnel and information security. Relations between security organizations and government agencies are also explored. 3 credits.

### **44.141 Police Functions: Theory and Applications**

Examines the historical development of police work with special emphasis on the conflicting role expectations facing the police officer. 3 credits.

### **44.151 Introduction to Corrections**

Provides a comprehensive view of the theory, practice and philosophy involved in the treatment of convicted law violators of all ages. 3 credits.

### **44.201 Computer Applications in Criminal Justice**

Provides the student with an introduction to the use and application of computers and computer programs in word processing, data processing and spreadsheet applications as they pertain to the field of criminal justice. By the end of the course, students will be able to utilize all three applications. This is a laboratory course. 3 credits.

**44.211 Physical Security**

Covers the basic principles of physical security, with emphasis on tailoring these principles to the protection of specific operations and facilities. In addition, students will learn the significance of proper planning, design, modern techniques and devices that enhance security while reducing costs. 3 credits.

**44.221 Criminology I**

Presents the definition and nature of crime, criminal statistics and a survey of theories of crime causation. 3 credits. Required for all Criminal Justice majors.

**44.233 Criminal Procedure**

Deals with the workings of the legal system as they pertain to the criminal justice professional. Particular emphasis will be placed on the proper legal procedures leading up to and including court proceedings. 3 credits.

**44.234 Criminal Law**

Discusses the historical origins and development of criminal law from early common law to contemporary decisions and statutes. Constitutional and statutory factors as they pertain to crime, defense, and crimes against persons and property will be considered. In addition, attention is directed toward limitations of criminal responsibility, capacity and the law of arrest. Sections of the Massachusetts Criminal Code and other statutes will be covered where applicable. 3 credits.

**44.241 Principles of Investigation**

Gives the student a solid understanding of the organization, techniques and procedures in carrying out a proper investigation. Some of the examples will include such topics as arson, larceny, sexual offenses, forgery and fraud. Other important aspects will include establishment of investigative priorities, fiscal restraints and informational management. 3 credits.

**44.243 Criminalistics I**

Presents basic procedures in arrest, search and seizure, and the gathering as well as the evaluation of evidence as to admissibility, weight and competence. 3 credits. Prerequisite: 2 semesters of science.

**44.244 Criminalistics II**

Discusses collections, identification, preservation and transportation of physical evidence. The crime laboratory and its effectiveness capabilities and limitations in assisting the police officer and utilizing physical evidence as a means of apprehension and/or conviction will also be addressed. 3 credits. Prerequisite: 44.243.

**44.261 Juvenile Delinquency**

Covers causative factors in the development of youthful offenders. The development and philosophy behind treatment of juvenile court and clinic, training schools and contemporary innovative practices will be covered. 3 credits.



**44.312 Security Management**

Covers the basic interdisciplinary principles of security management including planning, budgeting, organizing, staffing, directing and controlling. This course will also cover marketing security services to management, risk management, civil and criminal liability, and labor relations. Each aspect of the course is designed to prepare security managers to face the new challenges as broader and more cost-effective protection is required with fewer resources. The course will also bring about greater awareness and understanding of the various options available in security and loss control. It will identify a number of risk areas and outline various deterrent and preventative methods. 3 credits.

**44.321 Criminology II**

Examines the theories of criminal behavior, both historical and contemporary, and their impact on the evolution of punishment, treatment and rehabilitative practices. 3 credits. Prerequisite: 44.221.

**44.331 Penal Law**

Studies the constitutional rights of incarcerated individuals, including major policy issues and trends associated with recent revisions of penal codes reflecting court decisions for the preservation of offenders' rights. 3 credits.

**44.335 Juvenile Court: Philosophy and Practice**

Examines the civil procedures used in the juvenile court as opposed to the adversary procedures used in criminal court, together with a history of the development of the juvenile court and an examination of its constitutional basis. 3 credits. Prerequisite: 44.261.

**44.341 Comparative Police Systems**

Studies various police systems on the national and international level and makes a comparison with local systems on the basis of organization, structure, and administration of law enforcement agencies. Agencies in Europe, the United Kingdom, the Soviet Union and other parts of the United States will be reviewed. 3 credits.

**44.351 Alternatives to Corrections**

Discusses modern trends in corrections, such as the community-based programs in work-release, half-way houses, parole clinics, the therapeutic community and the team treatment concept in institutions. 3 credits. Prerequisite: 44.151.

**44.354 Probation and Parole**

Presents the historical development of both probation and parole, and provides an examination of their place in the criminal justice system. There will be an emphasis on recent trends including diversion, flat sentencing, week-end sentencing and the problems resulting from departure from traditional practices. 3 credits.

**44.360 Minorities and the Criminal Justice System**

Discusses both social and legal consequences of racism and discrimination as they pertain to minorities and the criminal justice system. 3 credits. Prerequisite: 44.234.

**44.370 Criminal Justice Management**

Introduces the principles of administration, including planning, budgeting, grantsmanship and evaluation as they relate to the criminal justice system. 3 credits.

**44.371 Criminal Justice Planning and Evaluation**

Serves as a continuation of 44.370, placing particular emphasis on student design and evaluation of programs and plans. 3 credits. Prerequisite: 44.370 or equivalent.

**44.372 Issues in Correctional Administration**

Conducts specific analysis of the management of correctional institutions, including custody, classification, reception, programming, release, staffing, scheduling, collective bargaining and other related issues. 3 credits. Prerequisite: 44.370 or equivalent.

**44.373 Issues in Police Administration**

Presents specific analysis of the management of the contemporary police force, including staffing, scheduling, training, collective bargaining, community relations and other related issues. 3 credits. Prerequisite: 44.370 or equivalent.

**44.380 Selected Issues in Criminal Justice**

Discusses current issues and problems in criminal justice. Subjects taken up in the course will vary but will include such questions as victimology, social and psychological aspects of crime, crime control and deterrence, evaluation and policy research. 3 credits.

**44.385 Crime and Mental Illness**

Considers the realities and myths surrounding the relation between mental illness and crime. An analysis of case studies and of material from criminal justice and psychology will be a major component of this course. 3 credits.

**44.390 Introduction to Criminal Justice Research**

Introduces research methods for the criminal justice professional. Topics include terminology, standard methodologies and elementary statistics. 3 credits.

**44.401 Drugs and the Criminal Justice System**

Covers the problems of drugs, drug abuse, the law and its application. Treatment of and alternatives to drug rehabilitation will be studied in addition to the classification, identification, distribution and control of drugs. 3 credits.

**44.410 Women in Criminal Justice**

Identifies and seeks to understand assumptions in theories and in practice as they relate to women as criminals, victims and criminal justice practitioners. Biological, psychological and sociological theories will be analyzed, and the implications of such theories will be discussed. Women's reactions to both the theories and practices will be examined. 3 credits.

**44.490 Criminal Justice Research Seminar**

Provides specific practice in the definition, design and execution of a research project. Presents an analysis of the impact of contemporary criminal justice research on policy development. 3 credits. Prerequisite: 44.390.

#### **44.496 Practicum**

Assigns field work under supervision and with permission of coordinator. This course is designed to broaden the educational experience of pre-service students in law enforcement and corrections by providing exposure in selected correctional, law enforcement, probation and parole agencies within the area. This course is intended to provide a correlation of theoretical knowledge with practical experience in an area of particular interest to the students. 3 credits.



## **Environmental Sciences**

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#### **87.103 Earth and Environment**

Investigates the interaction between science and man's understanding and use of the earth and its environment. Origin of the universe and solar system, the dynamic earth, earth resources, astronomical and geologic time are all discussed. 3 credit. Area III core course.

#### **87.111 A Planet at Risk**

Presents material designed to foster an understanding of the important natural systems that control the planet and are being endangered by a variety of threats. The course will provide a useful introduction to these systems and then focus on a series of major global and national environmental hazards. This class is designed to allow students to read and research topics of interest to them, with the emphasis on developing a better understanding of concepts, issues and environmental policy. There will be a variety of formats used, including lecture, selected readings, discussions, group and individual presentation. 3 credits.

#### **89.101 General Geology I**

Presents a study of the earth with emphasis on earth materials, earth structure (crustal and internal), earth history and the development of life. Gives the student an understanding of the dynamic earth and provides a foundation for advanced work. 3 credits. Corequisite: 89.103. Area III Science lecture core course.

#### **89.102 General Geology II**

Serves as a continuation of 89.101 with emphasis on the surface of the earth and landform development. Material includes special topics that introduce the student to recent geological research and applied geological knowledge. Designed for the general and continuing student. 3 credits. Prerequisite: 89.101. Corequisite: 89.104. Area III Science lecture core course.

#### **89.103 General Geology Laboratory I**

Corequisite: 89.101. Must be taken with 89.101 for Laboratory Science Area III lab requirement. 1 credit.

**89.104 General Geology  
Laboratory II**

Corequisite: 89.102. Must be taken with 89.102 for Laboratory Science Area III lab requirement. 1 credit.

**93.141 Weather and Climate**

Serves as a general meteorology course for the nonscience major. Topics include: atmospheric composition, solar radiation, temperature, moisture and condensation, relationship between air pressure and wind, weather patterns, severe weather, optical phenomena in the atmosphere, and the behavior and possible change of climate. 3 credits. Area III core course.

## Economics

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**68.201 Economics I  
(Microeconomics)**

Studies the principles governing the production and exchange of goods and services. 3 credits. Prerequisite: 90.111. Area I core course.

**68.202 Economics II  
(Macroeconomics)**

Presents the principles governing the level of national income and employment. An examination of the commercial banking system, monetary and fiscal policy, the international economy and alternative economic system will be conducted. 3 credits. Prerequisite: 90.111. Area I core course.

**68.207 Government, Business  
and Society**

Examines the various governmental controls over business in the American economy. 3 credits. Prerequisite: 68.201 or 68.202. Area I core course and Human Values core course for the Continuing Education student.



## **17.130 Electrical Basics and Laboratory**

Introduces the basic principles of electrical engineering, including the concepts of voltage, current, resistance, inductance and capacitance. Ohm's Law, Kirchhoff's Laws, Thevenin's theorem and Norton's theorem will be covered. Alternating current concepts, frequency response and filters are discussed. The use of laboratory power supplies and measuring instruments such as oscilloscopes, voltmeters, ammeters and ohmmeters are demonstrated. Computer terminals are available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. Not available for EET majors. 2 credits. Prerequisites: 42.226, 92.115, 92.219 or 92.263 and 99.132.

## **17.131 Electronic Basics and Laboratory**

Serves as a continuation and elaboration of 17.130. Topics include: diodes; transistors and electronic amplifiers; power supplies; and feedback and control systems. Magnetics and electromechanics, AC power systems and rotating machines are also covered. Computer terminals are available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. Not available for EET majors. 2 credits. Prerequisites: 17.130 and 42.226.

## **17.132 Digital Basics and Laboratory**

Presents an introduction to number systems and digital logic, including both combinational and sequential digital logic networks. Other topics include: binary, decimal, octal, and hexadecimal number systems; base conversion; Boolean algebra; Karnaugh maps; and sequential counters. Computer terminals are available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. Not available for EET majors. 2 credits. Prerequisites: 17.130 and 42.226.

## **17.213 Electric Circuits**

Covers electrical units; voltage, current and resistance; energy, power and charge; Ohm's Law, Kirchhoff's Current Law and Kirchhoff's Voltage Law; simplification and conversion techniques for networks containing sources and/or resistance; Thevenin's and Norton's theorems; fundamentals of magnetism and magnetic circuits; and meters and measuring. 3 credits. Prerequisites: 90.113, 92.125 (May be taken concurrently) and 92.219.

**17.214 Circuits and Laboratory I**

Provides a continuation of 17.213.

Topics include sinusoidal waveforms, phasors, impedance, network elements, rheostats and potentiometers. Mesh and nodal analysis of AC circuits; series and parallel circuits, series-parallel circuits, superposition and Wye/Delta conversions are also covered. The use of power supplies and measuring instruments such as oscilloscopes, voltmeters, ammeters and ohmmeters will be studied. Computer terminals are available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. 2 credits. Prerequisites: 17.213, 42.226, 92.126 (May be taken concurrently) and 92.115.

**17.215 Circuits and Laboratory II**

Serves as a continuation of 17.214.

Topics to be discussed include superposition; Thevenin's and Norton's theorems applied to sine wave excitations; maximum power transfer, real and reactive power; resonance; and polyphase systems. Oscilloscopes, voltage, current and phase measurements are demonstrated. Other topics include series and parallel sinusoidal circuits, series-parallel sinusoidal circuits, series resonance, parallel resonance and transformers. Computer terminals will be available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. 2 credits. Prerequisites: 17.214, 42.226, 92.126 and 92.115.

**17.216 Advanced Circuits**

Provides an extension and elaboration of the principles covered in 17.213,

17.214 and 17.215. Circuits and systems undergoing transient conditions caused by a variety of excitations, both natural and forced, will be explored using the Laplace-Transform method. Application to mechanical, fluidic, thermal circuits and filters are presented as an introduction to electromechanical, electronic and control systems. 3 credits. Prerequisites: 17.215 and 92.126.

**17.230 Mathematics & Statistics/  
E.E.T**

Uses the computer to apply mathematics, probability statistics, to technological problems. Topics include probability, statistics, regression, correlation, goodness of fit, variance, probability distributions and the computer solution of algebraic equations associated with multivariable statistical problems. 3 credits. Prerequisites: 17.350, 92.219 and 92.265 or 92.267.

**17.317 Minicomputer Programming**

Introduces the fundamentals of absolute and symbolic programming. Typical digital computer organization and operation from a register reference point of view are also presented. Computer instructions, word formats and symbolic coding, address modification, index register and looping will all be covered. Use of system programs including the Debug, Editor and Assembler; subroutines, calling sequences, multiple entry, and return are all examined. Program assignments will be run on one of the University's minicomputers. 3 credits. Prerequisites: 17.353, 17.356, 17.371 and 92.219 or 92.263.

### **17.350 Control Systems I**

Serves as a basic course in feedback control theory, which applies Laplace transform and frequency response. Approximation techniques are developed to achieve an optimum design of a practical multi-loop servo having velocity feedback and integral-network compensation. The general time behavior of a control system is studied, including the use of error coefficients to compute the angular error of a radar tracking antenna. 3 credits. Prerequisites: 17.216 and 92.126.

### **17.353 Digital Electronics**

Presents the building blocks and concepts associated with digital electronic networks. Combinational networks, Eber-Moll Transistor model, state devices, logic families (RTL, TTL, ECL, CMOS), read-only memories (ROM's), static and dynamic MOS random access memories (RAM's), programmable logic array (PLA's) and macro cell logic are discussed. 3 credits. Prerequisites: 17.356 and 17.371.

### **17.355 Electronics & Laboratory I**

Provides an introduction to electronic signals and systems. Amplifier characteristics and two-port networks will be presented. Diode characteristics and applications, rectifiers, power supplies, filters, comparators and limiters are also discussed. Computer terminals are available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. 2 credits. Prerequisites: 17.215 (May be taken concurrently), 42.226 and 92.126.

### **17.356 Electronics & Laboratory II**

Serves as a continuation of 17.355. Waveform generators, junction field-effect transistors (JFET's), graphical analysis, small signal equivalent networks, biasing and multistage amplifiers are covered. Computer terminals are available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. 2 credits. Prerequisites: 17.215, 17.355, 42.226 and 92.126.

### **17.357 Electronics & Laboratory III**

Continues 17.356, and discusses the following topics: metal-oxide-semiconductor field-effect transistors (MOSFET's), bipolar junction transistors (BJT's), as well as single and multi-stage amplifiers. Computer terminals are available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. 2 credits. Prerequisites: 17.356, 42.226 and 92.126.

### **17.358 Electronics & Laboratory IV**

Serves as a continuation of 17.357. Topics to be covered include: single and multi-stage amplifiers, frequency response, feedback, analog integrated circuits, filters and oscillator circuits. Computer terminals are available in the laboratory and their use is expected. Written reports are required. Alternate lecture and laboratory sessions. 2 credits. Prerequisites: 17.357, 42.226 and 92.126.

### **17.361 Project Laboratory A**

Outlines and discusses possible projects with students submitting detailed proposals. The most feasible projects are then assigned to teams of students for implementation. Use of the computer as a tool to solve experimental problems is encouraged. Written reports are required. 2 credits. Prerequisites: 17.353, 17.358 and 17.365.

### **17.365 Applied Linear Devices**

Discusses the linear and non-linear applications and characteristics of linear integrated devices. Optimal use of industry published specifications, application notes and handbook data will be stressed. Topics to be covered include operational amplifiers, regulators, comparators, analog switches, time function generators, instrument circuits, logarithmic circuits, computing circuits and signal processing circuits. 3 credits. Prerequisites: 17.350 and 17.357.

### **17.367 Digital Devices and Laboratory**

Provides students with an extension and elaboration of the topics covered in 17.353, 17.371 and 17.372. Topics include: logic devices (TTL, CMOS, ECL, and NMOS), interfacing between various logic families, propagation delay, three-state devices, totem pole and open collector structures and their uses, programmable logic devices, memory devices used as logic elements, digital timers and clock generators. A class design project involving the above devices will be required. Approximately one-half of the course time will be an associated laboratory. Written reports are required. 2 credits. Prerequisites: 17.353, 17.371 and 17.372 (May be taken concurrently).

### **17.368 Data Conversion and Laboratory**

Serves as a continuation of 17.367, covering the fundamentals of data conversion devices including R/2R ladder networks, weighted resistor and weighted source networks, analog-to-digital and digital-to-analog converters, voltage-to-frequency and frequency-to-voltage converters and sample and hold networks. Approximately one-half the course time will be an associated laboratory. 2 credits. Prerequisites: 17.353, 17.367 and 17.372.

### **17.371 Logic Design I**

Presents a study of number systems, switching algebra and combinational logic. Topics include: number systems; coding; switching algebra; minimization and decomposition of switching functions; using maps, tabular procedures and charts; basic logical gates and block diagrams; bilateral switching networks; and threshold logic. 3 credits. Prerequisites: 17.355 and 17.356 (May be taken concurrently).

### **17.372 Logic Design II**

Serves to extend the principles of 17.371 to sequential networks. Topics include: synchronous sequential networks: state diagrams and tables; transition tables; state assignment; merger graphs and tables; implication graphs; fundamental mode asynchronous sequential networks: and flow tables, cycles, races, and critical race free assignments. 3 credits. Prerequisite: 17.371.



**17.376 Electromagnetic Theory I**

Reviews vector analysis electrostatic theory and applications including electric field, potential, Gauss's Law, divergence, stored energy, boundary conditions, forces, dielectric materials, conductivity, electrostatic mapping, capacitance, as well as Poisson's and Laplace's equations. Magneostatic theory, including the magnetic field, Lorentz force, motion of charged particles in combined electric and magnetic fields, Amperes Law, inductance, stored energy, boundary conditions, magnetic materials, magnetics and superconductors are also covered. Applications including two-wire transmission line, electrostatic shielding, electrostatic photography, electron emission, bubble memory devices, magnetic shielding and magnetic circuit design will also be presented. 3 credits. Prerequisites: 17.358 and 92.226.

**17.380 Microprocessor Basics**

Provides an extension of topics covered in 17.353, based upon an integrated set of microprocessor experiments and related lectures. Topics include: hexadecimal and decimal conversion, BCD arithmetic, microprocessor programming, immediate and direct addressing, arithmetic and logic instructions, branching, index and extended addressing, subroutines, memory circuits, data input and output, introduction to PIA, digital-to-analog and analog-to-digital conversion, interfacing and various programming projects. Approximately one-half the course time will be an associated laboratory. 2 credits. Prerequisites: 17.356 and 17.371.

**17.382 Problems in E. E. Technology**

Discusses the techniques covered in Pascal programming and C programming that will be used extensively for the solution of problems related to electronic engineering technology. Various projects will be assigned to each student. 3 credits. Prerequisites: 17.353, 17.358, 92.234 and 92.265 or 92.267.

**17.391 Project Laboratory B**

Requires students to submit project proposals compatible with the advanced technical electives offered. Teams are then assigned to implement selected projects. Use of the computer as a tool to solve experimental problems is encouraged. Written laboratory reports are required. Credit by examination will not be granted for this subject. 2 credits. Prerequisites: 17.361, 17.367, 17.382 and at least one 17.4-- Electronic Engineering Technology elective.

**17.392 Project Laboratory C**

Requires students to submit project proposals compatible with the advanced technical electives offered. Teams are then assigned to implement selected projects. Use of the computer as a tool to solve experimental problems is encouraged. Written laboratory reports are required. Credit by examination will not be granted for this subject. 2 credits. Prerequisites: 17.361, 17.367, 17.382 and Electronic Engineering Technology elective.

**17.427 Digital Signal Processing**

Presents the fundamentals of discrete-time signals and systems analysis. Z-transforms, discrete Fourier Transforms, and Fast Fourier Transform (FFT) algorithms are discussed. Digital filter design techniques for various filter types (IIR and FIR) are developed. Time domain filtering based on discrete time Kalman filters is also presented. Computer solution of filtering problems is an integral part of the course. 3 credits. Prerequisites: 17.353, 17.358, 92.234 and either 92.265, 92.267 or 92.263.

**17.431 Electromagnetic Compatibility**

Provides a working knowledge of electromagnetic interference (EMI) and compatibility (EMC), while illustrating actual interference situations and their solutions. This course will cover the characteristics of conducted and radiated interference and electromagnetic pulse (EMP) effects. Interference coupling mechanisms will be considered. Solutions to interference problems based on grounding, shielding and filtering techniques will be discussed. Emphasis will be placed on practical design procedures. Design issues regarding inter-system interference will be addressed. The course will also cover industrial and government standards, as well as EMC measurement and test procedures. 3 credits. Prerequisite: 17.376.

**17.459 Power Converter Design I**

Discusses the design of modern switching and linear power supplies, basic voltage regulators and power converters, square-wave power converters and regulators. Compound regulating systems, thermal considerations, series-pass regulators, DC/DC converter design, switching regulators and converters are also covered. 3 credits. Prerequisites: 17.350 and 17.365 .

**17.460 Power Converter Design II**

Serves as a power converter design course dealing with the more popular types of modern high frequency switching converters at the 150 to 500 watt level. This course is a continuation of 17.459, with emphasis on network analysis using Laplace Transforms and some BASIC programming. The analysis will be used to determine component stresses. Techniques for determining the stability of switching and linear regulators will also be presented. 3 credits. Prerequisite: 17.459.

**17.469 Control Systems II**

Serves as an extension of 17.350. A practical and complex multi-loop servo is studied in detail. The servo has feedback of current, velocity and position, along with integral compensation, and includes the dynamics of mechanical resonance in the gear train. The error due to static friction is analyzed. Sampled-data theory is presented and applied to develop a method of dynamic computer simulation which can be implemented in the BASIC computer language. The servo system previously analyzed is simulated with this technique. 3 credits. Prerequisite: 17.350.

**17.473 Logic Design III**

Serves as a continuation of 17.372. Pulse mode asynchronous networks, iterative networks, the structure of sequential networks, sets, relations and lattices, state assignment using partitions, serial and parallel decomposition, decomposition with specified components, state identification and fault detection experiments, linear sequential networks and applications of digital logic are all addressed in this course. 3 credits. Prerequisite: 17.372.

**17.477 Electromagnetic Theory II**

Reviews Maxwell's equations. The wave equation for free space propagation is discussed. The concepts of a time varying electromagnetic field, sinusoidal plane waves, planewaves in dielectric and conductive media, Poynting's vector, depth and penetration, force and radiation pressure, reflection of EM waves from perfect conductors, dielectrics, and multiple dielectrics will all be covered. Quarter wave and half-wave matching, polarization, Brewster's angle and surface waves are also discussed. Introductory concepts in guided electromagnetic waves including transmission lines, waveguides and antennas from the viewpoint of Maxwell's equations will be explored. 3 credits. Prerequisites: 17.376 and 92.234.

**17.478 Applied Electromagnetics**

Presents the conventional two-conductor transmission line theory with emphasis on those results which can be applied to the analysis and design of waveguide transmission. A discussion of the most frequently used microwave oscillators, the magnetron and klystron, is presented. The traveling wave tube concept is also emphasized. The interaction of microwave radiation with magnetic materials and practical devices of importance will be studied. Special problems encountered when microwave techniques and methods are extended to the millimeter-wavelength limit of the microwave domain will be reviewed. 3 credits. Prerequisites: 17.376 and 92.234.

**17.479 Optoelectronics**

Provides a theoretical and practical introduction to optical and electronic devices used for the emission, control, propagation and detection of optical radiation, and the processing of resulting signals. A review of the physics of optical radiation and an introduction of black body radiation, photometry and radiometry will be conducted. In addition, a survey of both classical and coherent radiation sources is presented. The laser and its technological and telecommunication application as well as the detection of optical radiation from the ultra-violet to the infrared will be covered. Detector characteristics, optical components such as lenses, mirrors, beamsplitters and telescopes used in the transmission and reception of optical radiation; filters, polarizers, modulators, scanners required to select, shape and direct optical radiation will be discussed and their application in systems of current interest presented. 3 credits. Prerequisites: 17.368 and 17.376.



**17.483 Microprocessor Hardware**

Provides an introduction to the design of a 16 bit microprocessor system. The hardware requirements of interfacing the 8086 microprocessor to memory devices, EPROMs, dynamic RAMs and static RAMs as well as I/O devices are covered. The interface to the various microprocessor peripherals such as the Coprocessor, Bus Arbiter, DMA Controller, Programmable Interrupt Controller, and Dynamic Ram Controller is investigated. The 8086 system is compared to the 68000 system. 3 credits. Prerequisites: 17.367, 17.371 and 17.380.

**17.484 Microprocessor Software**

Presents a study of the architecture and instruction set of the 8086 microprocessor. Subject areas include: addressing modes, data movement instructions, flag operations, arithmetic and logical instructions, bit manipulation instructions, primitive string operations, program control instructions, flow-charts, hardware control instructions, interrupt structures and procedures. Some of the peripheral devices of the Intel family are covered as well. Students will be required to develop programs that exhibit their knowledge of both the instruction sets and good programming practices. The interpretation of written programs will also be investigated. 3 credits. Prerequisites: 17.367, 17.371 and 17.380.

**17.485 Communication Theory I**

Offers an introduction to information, transmission and communication systems. Review of Fourier series and Fourier integrals, discussion of amplitude and frequency modulation systems will be a part of this class. An introduction to noise in electrical systems is also presented. 3 credits. Prerequisite: 17.376.

**17.486 Communication Theory II**

Serves as a continuation of 17.485. Pulse amplitude modulation (PAM), pulse code modulation (PCM) and pulse position modulation (PPM) systems will be discussed and analyzed. Detection theory, matched filtering signal design and receiver performance are also presented. Concepts of spread spectrum systems are also introduced. 3 credits. Prerequisites: 17.485 and 92.234.

**17.487 Analog Filter Design**

Presents a review of network analysis. This course also provides an introduction to synthesis, driving point impedance, approximation theory and transfer function realization. 3 credits. Prerequisites: 17.350 and 92.234.

**17.490 Advanced Microprocessors**

Studies the design of a 32-bit microprocessor systems using the Intel 80386 and Motorola 68020, and the hardware requirements of interfacing the 32 bit data buses to memory devices. The interface to the various microprocessor peripherals such as the Intel 80387 and the MC68881 Coprocessors as well as the MC68851 Paged Memory Management Unit is investigated. System architecture including multitasking, virtual address translation, paging and protection schemes are also covered. 3 credits. Prerequisites: 17.367, 17.371 and 17.483.



### **17.495 Microprocessor Control**

Provides an introduction to computer peripheral controllers that interface to mass storage devices and communication networks. The hardware requirements of interfacing to hard disk, tape, cassette and floppy are studied. Other topics considered are the various communication protocols and the interface to local communication networks such as Ethernet and Starlan. Also considered are global communications using ASYNC, BISYNC, and SDLC/HDLC. The necessary requirements to interface an 80188 microprocessor to each controller will be defined. 3 credits. Prerequisites: 17.367, 17.371 and 17.380.

### **17.496 Radar Systems**

Offers an introduction to radar system analysis. An overview of basic radar operation is followed by a discussion of the factors influencing the radar operations of target detection and parameter estimation. Transmitters, antennas, receivers and system losses will be discussed. Propagation effects and clutter interference will be presented. Signal processing techniques will be described. Synthetic aperture radar and pulse compression techniques will also be discussed. Time permitting, various applications will be described. 3 credits. Prerequisites: 17.358, 17.376, and 92.234.

## **English**

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### **42.101 College Writing I**

Teaches the preparation of expository and argumentative essays as well as the critical reading of non-fiction. The class includes a study of the techniques and documentation of research. 3 credits. English composition requirement.

### **42.102 College Writing II**

Provides written and class work that reinforce the standard 42.101. Imaginative literature representative of the major types will be studied as a basis for further developing competence in writing. 3 credits. Prerequisite: 42.101. English composition requirement.

### **42.103 College Writing I for International Students**

Serves as the equivalent to 42.101, for students who speak English as a second language. Credit for both 42.101 and 42.103 may not be granted. 3 credits. English composition requirement.

### **42.104 College Writing II for International Students**

Serves as the equivalent to 42.102, for students who speak English as a second language. Credit for both 42.102 and 42.104 may not be granted. 3 credits. Prerequisite: 42.103. English composition requirement.

**Note: Before enrolling in any English course numbered 42.201 or higher, students must complete 42.101, 42.102 (or their equivalent 42.103 and 42.104) to fulfill the University requirement of 6 hours in composition.**

### **42.201 Great Books of Antiquity**

Studies representative literary selections from the Bible, classical Greece and imperial Rome as embodiments of ancient views of life and reality. 3 credits. Area II core course.

#### **42.202 Great Books of the Modern Period**

Studies representative literary selections from the period of the Enlightenment to the present as embodiments of modern views of life and reality. 3 credits. Area II core course.

#### **42.205 Human Values in Western Culture I**

Presents a close study of representative literary, philosophical and religious texts from ancient times to the present, as well as relevant modern works in the behavioral and political sciences. In the first semester, students explore and evaluate three perennial themes: the problem of evil, self and society, freedom and fate. 3 credits. Human Values core course.

#### **42.206 Human Values in Western Culture II**

Serves as a continuation of 42.205, but may be taken independently. Themes to be explored include the pursuit of knowledge, the nature of mankind, and the experience of love. 3 credits. Human Values core course.

#### **42.210 Drama**

Presents a study of a representative group of significant plays, both traditional and contemporary, designed to develop students' abilities to understand and appreciate drama and to acquaint them with the characteristics of this type of literature. 3 credits. Area II core course.

#### **42.211 Poetry**

Studies selections from the Renaissance through contemporary periods. 3 credits. Area II core course.

#### **42.212 The Short Story**

Offers a study of the development of the genre. 3 credits. Area II core course.

#### **42.215 The Modern Essay**

Provides a study of the essay as the literature of ideas, and presents a concentration of twentieth century writers with attention to early examples of the genre. 3 credits.

#### **42.216 The Short Novel**

A study of nineteenth and twentieth century short novels as a literary genre. 3 credits.

#### **42.217 The Horror Story**

Covers the genre from Poe to the present. 3 credits. Area II core course.

#### **42.218 Comedy**

Presents the theory and practice of comedy from the Greeks to the present. 3 credits. Area II core course.

#### **42.220 Creative Writing: Personal and Reflective Writing**

Provides an emphasis on the writing process as students prepare autobiographical projects. Class time will focus on selected professional autobiographies and memoirs, as well as student writing. 3 credits.

#### **42.222 Oral Communication**

Develops and applies the basic speaking skills that can be adapted to a variety of personal and professional contexts. Emphasis is placed on selection, analysis, organization and presentation of speech materials. Practice skills include listening, interviewing and the delivery and critique of extemporaneous speeches. 3 credits.

**42.224 Business Writing**

Studies the theory and practice of writing letters, memoranda and reports on specific business and technical problems. Registration preference for students enrolled in Business and Management programs. 3 credits. (May not also take 42.226.)

**42.225 Basic Technical Writing**

Covers writing effective letters, memoranda and reports on specific scientific and technical subjects while considering issues of audience analysis, editing and the use of graphics. 3 credits.

**42.226 Technical and Scientific Communication**

Studies the theory and practice of letters, memoranda, reports and oral presentations on specific scientific and technical problems. 3 credits. (May not also take 42.224)

**42.227 Advanced Expository Writing**

Reviews the major modes of exposition with emphasis on the writing process. The course focuses on structure, audience and the development of style. 3 credits.

**42.230 Elements of Film**

Studies the elements of film as revealed in selected film classics with emphasis on analysis and evaluation. 3 credits.

**42.231 The Documentary Film**

Discusses the history and theory of non-fiction film as a way of recording and interpreting human events and natural phenomena. Through class discussions and numerous screenings of documentaries (including *North*, *Louisiana Story*, and *Strike*) the film maker's purpose and techniques will be examined. 3 credits.

**42.240 Literature and Women**

Surveys literary attitudes towards women from the Judaic and Hellenic periods through the contemporary. 3 credits.

**42.241 Women in Film**

Surveys the image of women in commercial film from its beginnings to the present, with emphasis on the films of the 1930's and 40's and the 1970's and 80's. Several commercial viewings will be scheduled. 3 credits.

**42.242 The Heroine in Modern Fiction**

Provides a study of selected short stories and novels which deal sympathetically with the changing roles of women. 3 credits.

**42.250 The Bible as Literature**

Presents a literary and historical analysis of selected Old and New Testament books. 3 credits.

**42.261 Acting**

Presents a study of the theory and practice of acting, including exercises in the elements and methods of acting as well as the preparation of a public performance. Although a textbook will be used as an easy reference for acting exercises, the course will concentrate on scenes and monologues developed by the student. 3 credits.

**42.262 Advanced Acting**

Designed for acting students who have experience in amateur productions or may be considering careers in the field. Class work will involve rigorous training with theater professionals and will include text analysis, performance techniques, and the actor's role in the production process. Limited Enrollment. 3 credits. Prerequisite: 42.261, its equivalent, or permission of the instructor.

**42.264 Directing**

Serves as an introduction to the process of directing a play. The evolution of the director's role in production and the techniques of play analysis, actor rehearsal and production design will be emphasized. Students will have the opportunity to direct in a scene study laboratory. Limited Enrollment. 3 credits.

**42.267 Introduction to Shakespeare**

Studies selected histories, comedies and tragedies. 3 credits. Area II core course.

**42.291 History of English Literature I**

Studies the historical development of English literature from its beginnings to Milton. Selected works by representative authors from each period are studied. 3 credits. Area II core course.

**42.292 History of English Literature II**

Studies the historical development of English literature from Dryden to the beginning of the twentieth century. 3 credits. Area II core course.

**42.294 History of American Literature I**

Studies the historical development of American literature from the Colonial period to the Civil War. Selected works by representative authors from each period are studied. 3 credits. Area II core course.

**42.295 History of American Literature II**

Studies the historical development of American literature from the Civil War to World War I. 3 credits. Area II core course.

**42.296 History of American Literature III**

Studies twentieth century American short stories, novels, poetry and drama. 3 credits.

**42.300 Journalism**

Addresses the basics of news, feature, and editorial writing; preparing for interviews and news conferences; as well as writing and reporting on speeches. It also covers the essentials of photo selection, editing and captioning. 3 credits.

**42.302 Creative Writing: Fiction I**

Emphasizes practical approaches to fiction writing with students' work as the focus of class discussion. Students will gain an understanding of the choices available in order to express convincingly the understanding and truth every writer seeks to communicate. 3 credits.

**42.303 Creative Writing: Poetry I**

Combines discussion and critique of student work with readings in contemporary poetry. It addresses two questions: "What makes good poetry?" and "What makes poetry good?" 3 credits.



**42.304 Creative Writing:  
Playwriting I**

Studies the theory and practice of playwriting. The course begins with exercises (monologue, scene work) to develop the basics of dialogue and character, and moves toward structural issues as students complete a dramatic piece. 3 credits.

**42.305 Reviewing the Arts**

Provides instruction in writing short, critical essays in a journalistic mode on the performing or visual arts. Special emphasis is given to theatre, movie and television criticism. 3 credits.

**42.306 Professional Writing**

Introduces the student to writing for business, government and the professions. Topics include copywriting and editing, resumes, memoranda, letters, instructions, reports and proposals. 3 credits.

**42.317 British Literature of the  
Twentieth Century**

Studies British short stories, novels, poetry, and drama. 3 credits. Area II core course.

**42.330 The Twentieth Century  
British Novel**

Presents a study of the novel from Conrad through Greene. 3 credits.

**42.362 Modern Drama**

Studies selected continental, British and American plays of the late nineteenth century to the present. 3 credits.

**42.365 Creative Writing: Fiction II**

This workshop allows students to present their work for encouraging and constructive criticism. The focus is on the development of the writer's ability to see what needs revision. 3 credits.

**42.366 Creative Writing: Poetry II**

This workshop combines discussion and critique of student poems with readings in contemporary poetry and poetics. The focus is on enabling students to develop their individual voices, forms, and subjects. 3 credits. Prerequisite: 42.102, its equivalent or permission of the instructor.

**42.367 Creative Writing:  
Playwriting II**

Assumes students have some command of playwriting building blocks (character, dialogue and action) and will guide the student through the writing of a full-length or a substantial one-act play. Classes will include a weekly laboratory with student actors who will stage scenes in the process of development. Students should come to the first class prepared to discuss the play they are writing or intend to write. 3 credits.

**42.381 The Existential Hero**

Studies the development of the existential hero in selected works by Stendahl, Melville, Dostoevsky, Hemingway, Gide, Sartre, Camus and Beckett. 3 credits.

**42.410 Editing and Publishing**

Presents students with the opportunity to study and apply basic editorial techniques within the context of present-day journalism and publishing practices. 3 credits. Prerequisite: Previous enrollment in an appropriate introductory level course, its equivalent, or permission of the instructor.

# History

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## **43.105 Western Civilization**

Traces the major forces in the development of European history from the fall of the Roman Empire to 1715. 3 credits. Area II core course.

## **43.106 The Modern World**

Examines the major forces in the development of modern European history from the French Revolution to the present. 3 credits. Area II core course.

## **43.111 United States History to 1877**

Traces the development of American history and institutions from colonization to the end of Reconstruction. Not open to history concentrators. 3 credits. Area II core course.

## **43.112 United States History Since 1877**

Examines significant developments in American history from the end of the Reconstruction period to the present. Not open to history concentrators. 3 credits. Area II core course.

## **43.206 American Economic History**

Studies the growth and development of the American economy from its European origins to the present. 3 credits. Area II core course.

## **43.242 The Second World War**

Presents a general survey of the war, together with a closer examination of selected topics. 3 credits. Area II core course.

## **43.277 Ethnic Groups in American Life**

Examines the importance of ethnic groups in American history. The course will treat several major ethnic groups and assimilation or non-assimilation into American life. Field work and research on ethnic groups in the Merrimack Valley is expected. 3 credits.

## **43.279 History of Lowell**

Examines the history of industry, politics and the culture of the city of Lowell. 3 credits.

## **43.363 Recent U.S. History, 1940 to Present**

Discusses the involvement of the U.S. in World War II, which marked a major turning point in American history. This ushered in decades of Cold War tensions, the militarization of society and participation in foreign alliances and limited wars. Anti-communist conservatives, militant Blacks and a New Left polarized politics and produced a contemporary crisis of confidence in American society. 3 credits. Prerequisite: 30 credits. Area II core course.

## **43.382 The American West**

Involves readings and discussions of the history of the American frontier and the place of the frontier in American society and thought. 3 credits. Prerequisite: 30 credits.

# Industrial Technology

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## **20.105 Introduction to Design**

Introduces students to industrial practice in design graphics. Topics include graphs, orthographic projection, sectioning, limit dimensioning, gear trains, cams and fasteners. One four-period session per week (2 lecture; 2 lab). 3 credits.

## **20.112 Machine Tool Processes**

Presents an introduction to fundamental machine shop techniques including machining practice, measurement and layout, and general shop safety. The objective is to develop an appreciation for basic machine tool practices utilized in manufacturing and knowledge of process and tooling specifications for operations planning. Practical exposure enhances the ability to communicate concepts regarding maintenance, prototype and production projects. One four-period session per week (2 lecture; 2 lab). 3 credits. Prerequisite: 20.105.

## **20.152 Water Biology**

Serves as an introduction to the biology of natural waters. Topics include freshwater animals, plants, community relationships, population dynamics, effects of pollution and water borne disease. Includes some lab and field work. 3 credits.

## **20.153 Aquatic Ecology**

Studies the principles and concepts involved in marine and fresh water ecology. This course explores biogeochemical cycles, population dynamics and water pollution. Field trips are planned to a fresh water stream or pond and to a local marine tidal zone, where collections and identification of various organisms are made. Practical lab work with relevance to ecology is also involved. 3 credits. Prerequisite: 20.152.

## **20.201 Introduction to Materials**

Provides a practical study of the relationship between properties, composition and structure of metals, ceramics and composites. This course includes selection, crystal structure, alloy phase diagrams, solidification and heat treating principles of metals as well as their application in normal and extreme environmental conditions. Laboratory (20.211) investigations reinforce lecture material but emphasize testing procedures for materials. 3 credits. Prerequisite: 84.111. Corequisite: 20.211.

## **20.209 Computer-Aided Design**

Serves as a continuation of 20.105, focusing on the use of the microcomputer as an aid to design. Computer Aided Design, CAD, involves the study of the use of the computer as a design tool. Geometric modeling techniques are examined in relation to practical design and manufacturing applications. Other topics include: principles of computer graphics, two and three dimensional modeling, database manipulation, and CAD system components. 2 credits. Prerequisite: 20.105.

**20.211 Materials Laboratory**

Involves laboratory studies designed to accompany 20.201, with emphasis on testing procedures for materials. 1 credit. Corequisite: 20.201.

**20.225 Water Chemistry I**

Covers basic chemical theory. Reactions and equations are presented, along with an introduction to the structure and character of water, its impurities and the chemical treatment schemes that have been devised to deal with them. 3 credits.

**20.226 Water Chemistry II**

Serves as a continuation of 20.225. The course covers specific water and wastewater treatment practices, such as chlorination, coagulation, filtration and absorption, with a focus on analytical techniques for the particular parameters of interest. Wet chemistry as well as instrument methods are discussed and demonstrated during lab sessions that complement the lecture material. 3 credits. Prerequisite: 20.225.

**20.251 Wastewater Treatment Plant Operations I**

Assumes that students are not familiar with plant operations. Lectures begin on preliminary treatment and proceed through primary and various types of secondary treatment focusing on activated sludge, chlorination, sludge dewatering and ultimate disposal. The primary emphasis is on the conventional activated sludge process. 3 credits. Corequisite: 20.253.

**20.252 Wastewater Treatment Plant Operations II**

Available to those who have taken 20.251, or to plant operators experienced in biological treatment. Control of the activated sludge process is emphasized, based upon solids balancing, using the centrifuge and settleometer. In addition, industrial wastes and advanced wastewater treatment are covered, including the removal of phosphates and nitrates. 3 credits. Prerequisite: 20.251. Corequisite: 20.254.

**20.253 Wastewater Treatment Lab I**

Serves as an introductory course, teaching the basic laboratory techniques and procedures used to operate and monitor conventional wastewater treatment facilities. Included are solids, chlorine residual, pH, BOD, total coliform, alkalinity, acidity, sludge and microscope analysis. 1 credit. Corequisite: 20.251.

**20.254 Wastewater Treatment Lab II**

Serves as an advanced course designed to teach the lab techniques and procedures used to operate and monitor advanced wastewater treatment facilities. Included in the course are "West" method, nitrification, phosphorous, jar test, CODD, BOD, TOC, total coliform, turbidity and chloride analysis. 1 credit. Prerequisite: 20.253. Corequisite: 20.252.



**20.255 Water Distribution Systems**

Introduces the principles, materials and practices relative to the operation and maintenance of drinking water distribution systems. The following topics will be covered: system hydraulics, pumping, mains, services, valves, hydrants, metering, flushing, storage, fire control, leak control, cross connection prevention, disinfection, etc. 3 credits.

**20.257 Water/Wastewater Plant Management**

Presents an introduction to the principles of management with emphasis on topics related to the operation of water and wastewater treatment plants. The following subjects are discussed: staffing, labor relations, public relations, financing, budgeting, legislation and management principles. 3 credits.

**20.303 Mechanical Systems**

Offers an introduction to the design or selection of mechanical elements used in the transmission of power in industrial equipment. Elements considered include shafts, pulleys, gears and gear trains, bearings, clutches, brakes and springs. 3 credits. Prerequisite: 23.221 and 23.223.

**20.305 Manufacturing Processes**

Serves as a continuation of 20.112, which introduces the student to various processes used by modern industry in the creation of a product. Basic manufacturing organization and concepts are also covered. Topics include EDM, ECM, lasers, casting, forming, chemical machining, finishing and abrasives. One session per week. 3 credits. Prerequisites: 20.105 and 20.112.

**20.307 Fluid Power Control**

Presents the elements of hydraulic and pneumatic power systems and their control. Elements such as cylinders and valves are studied in detail and combined to form complete circuits coupled with relay and pneumatic control. One four-hour session per week (2 lecture; 2 lab). 3 credits. Prerequisite: 23.221.

**20.309 Process Measurement and Control**

Introduces process control system technology. Liquid level, rate of flow, pressure and temperature measuring devices and their characteristics are covered. R-C of system components will also be presented. Integral, dead-time and first order lag processes, as well as control modes, bode diagrams and frequency response will be covered. One three-hour session per week (1 lecture; 2 lab). 2 credits. Prerequisites: 17.132 and 92.263.

**20.310 Industrial Safety**

Provides a practical study of industrial safety and accident prevention. Course material includes hazard analysis, safety management, technological remedies and risk management. Numerous practical cases are presented and the roles of governmental agencies in safety are analyzed. 3 credits.

**20.314 Motion and Time Study**

Presents methods improvement and work measurement techniques, including principles of motion economy, work simplification, process and operator charts, work sampling and time standards. 3 credits. Prerequisites: 20.112 and 90.113.

### **20.351 Water Supply and Treatment Operations I**

Provides an introduction to the principles and practices of operation and maintenance relative to drinking water supplies and treatment plants. Using case studies, the following topics are covered: sources of supply, well and reservoir operation, contaminants and regulation, hazardous materials, overview of treatment, chemical feeding, coagulation, settling, operating conditions, filtration, solids handling, disinfection, chlorination and fluoridation. 3 credits. Prerequisites: 20.152 and 20.226.

### **20.352 Water Supply and Treatment Operations II**

Provides a continuation of 20.351, covering the following topics: corrosion control, oxidation and aeration, use of ozone, chlorine dioxide and potassium permanganate, iron and manganese carbon, softening, instrumentation and control, system contamination control, reverse osmosis, ultrafiltration, electro-dialysis, distillation and UV, and energy management. 3 credits. Prerequisite: 20.351.

### **20.353 Water Works Operations Lab I**

This laboratory course will introduce the student to fundamental laboratory equipment as it applies to the operation of water treatment facilities. The following determinations will be conducted: odor, test, color, turbidity, jar tests, pH, chlorine residual, acidity, alkalinity, hardness, chlorides, iron, manganese, phosphate, aluminum, nitrogen, cycle, coliform, microscopic analysis, heavy metals, and organics. 1 credit.

### **20.354 Industrial Waste Treatment**

Presents an introductory approach to the operation and control of the major types of industrial waste treatment processes. The industrial waste treatments discussed include the following industries: textile, food processing, paper, metal finishing and tanneries. This course includes basic labor work to include pH, alkalinity, acidity, chlorine residual and solids. 3 credits.

### **20.355 Water Works Operations Lab II**

Serves as a continuation of 20.253, and includes the following topics: fluoride, fecal, coliform, phosphate, algae and microscopic analyses, filterability, TKN, TOC, heavy metals with AA apparatus, activated carbon assessment, and laboratory quality assurance. 1 credit. Prerequisite: 20.353.

### **20.356 Hazardous Waste Management**

Addresses the current topic of hazardous waste management in an interdisciplinary manner. Topics include hazardous waste regulations, regulatory agency functions, industrial hazardous waste management systems (contingency plans, closure plans, spill control plans, etc.), treatment, storage and disposal techniques (present and future), facility siting, source reduction techniques and right-to-know legislation. 3 credits.

**20.405 Senior Project**

Serves as the capstone course in the program. The objective of this class is to integrate previous coursework for the purpose of application to a real problem in manufacturing engineering technology. The course consists of a project that is judged on planning, proposing and execution, as well as progress reports and a final presentation. 3 credits. Prerequisite: one hundred semester credit hours completed in the program.

**20.406 Thermodynamics**

Acts as an introduction to the laws and concepts of thermodynamics including the first and second laws, properties of liquids and gases, and common power cycles. Included in the course is an overview of the energy problem and power generation technologies, both established and novel. 3 credits. Prerequisites: 23.221, 84.111, 92.126, 99.132.

**20.408 Microprocessors**

Serves as a continuation of 20.309, with emphasis on the use of microprocessors in programmable controllers. A laboratory supplements the theory. One three-hour session per week (1 lecture; 2 lab). 2 credits. Prerequisite: 20.309.

**20.414 Industrial Economic Management**

Offers an analysis of available alternatives in equipment, plant and materials purchasing or leasing. Economic feasibility analysis of industrial projects including depreciation techniques, break-even analysis, benefit-cost techniques, replacement, present worth and rate of return analysis will be covered. 3 credits. Prerequisites: 67.101 and 68.201.

**20.416 Statistical Quality Control**

Studies traditional and current statistical techniques applied to solutions of quality problems, quality maintenance and quality improvement activities. Statistical evaluation, process capability, control charts, sampling plans, correlation, regression analysis and optimization are discussed. 3 credits. Prerequisites: 20.305 or 69.271, 92.386.

**20.419 Computer-Aided Manufacture**

Presents Computer Aided Manufacturing, CAM, which is concerned with the use of the modern computer to assist in the manufacturing process. Topics include computer techniques for controlling machine tool motions, computer aided process planning, applications of group technology and cellular manufacturing. (1 lecture, 2 lab). 2 credits. Prerequisites: 20.205 and 20.305.

**20.427 Plant Layout and Materials Handling**

Studies materials flow and layout of production, assembly and service departments, manufacturing, buildings, and service facilities. Materials handling equipment and packaging techniques are also covered. 3 credits. Prerequisite: 20.205.

**20.452 Operation and Maintenance of Wastewater Collection Systems**

Examines the proper operation and maintenance of wastewater collection systems. Inspection, testing, installation, and repairs of the collection system are covered. Health hazards encountered in this work are addressed and safety is emphasized. Pumping station operation and maintenance are discussed in detail. Confined space entry and working in hazardous environments are also addressed. 3 credits.



## Interdisciplinary Courses

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### **00.101 Values and Creative Thinking**

Helps students succeed in their return to the educational environment. This course can help you integrate your knowledge of yourself, your values and your educational goals. It also focuses on the skills that are necessary to succeed at the University such as writing and critical and creative thinking. 3 credits. Human Values core course.

### **59.203 Technology and Human Values I**

Serves as a team-taught course about the interrelationship of technology and human values. It begins with an exploration of the Industrial Revolution in Lowell, followed by an examination of topics drawn from areas such as: agriculture, third world development, population control, energy and natural resources, household technology, and transportation. Unifying themes are the values associated with science and technology, the role and responsibility of the scientist and technologist, and the question of whether scientific and technological development should be and can be controlled. 3 credits. Human Values core course and Area I core course.

### **59.204 Technology and Human Values II**

Serves as a continuation of 59.203. 3 credits. Human Values core course and Area I Core course.

### **59.205 Human Values in Western Culture I**

Addresses some of the important questions of human existence through a close study of representative literary, philosophical and religious texts from ancient times to the present, as well as relevant modern works in the behavioral and political sciences. In the first semester, the students explore and evaluate three perennial themes: the problem of evil, self and society, and freedom and fate. 3 credits. Area II core course.

### **59.206 Human Values in Western Culture II**

Serves as a continuation of 59.205. In the second semester, the thematic units are the pursuit of knowledge, the nature of humankind and the experience of love. May be taken independently of 59.205. 3 credits. Area II core course.

### **59.214 Nuclear Weapons, Values and Society**

Examines popular values and conceptions concerning nuclear weapons and of the political, diplomatic and economic issues surrounding those weapons. An analysis of the strategic and political interests of the major powers and of alternatives to the nuclear arms race will be conducted. 3 credits. Human Values core course.



# Languages

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Beginning and intermediate courses at the 101-102 and 211-212 levels must be elected for two consecutive semesters and in the prescribed sequence. College credit may not be granted for one semester of such courses unless exception is permitted by the Chairperson of the Department of Languages on the basis of student placement in a more advanced language course.

## **50.101 Beginning French I**

Provides instruction in the development of fundamental skills in oral expression, aural comprehension, reading and writing. Tapes available for laboratory use. Students who have completed more than one year of French at the secondary level are ineligible for this course. 3 credits.

## **50.102 Beginning French II**

Serves as a continuation of 50.101, which is a prerequisite. 3 credits.

## **50.211 Intermediate Conversational French I**

Reviews basic grammatical structures and idiomatic patterns with emphasis upon increased proficiency in oral expression and aural comprehension. This course is intended for students who have completed two years of high school French, preferably during their junior and senior years, or for students who have completed 50.102. 3 credits. Area II core course.

## **50.212 Intermediate Conversational French II**

Serves as a continuation of 50.211, which is a prerequisite, with emphasis on continued development of comprehension and conversational skills. 3 credits. Area II core course.

## **51.101 Beginning German I**

Offers instruction in the development of fundamental skills in oral expression, aural comprehension, reading and writing. Tapes available for laboratory use. Students who have completed more than 1 year of German at the secondary level are ineligible for this course. 3 credits.

## **51.102 Beginning German II**

Serves as a continuation of 51.101, which is a prerequisite. 3 credits.

## **51.211 Intermediate German I**

Reviews German grammar and syntax with emphasis upon increased proficiency in reading, aural comprehension and oral expression. This course is intended for students who have completed two years of high school German, preferably during their junior and senior years, or for students who have completed 51.102. 3 credits. Area II core course.

## **51.212 Intermediate German II**

Serves as a continuation of 51.211, which is a prerequisite, with emphasis upon continued development of comprehension and conversational skills. 3 credits. Area II core course.

### **53.104 Chinese Civilization and Culture**

Considers Chinese culture and civilization up to the present. Through audio-visual aids, demonstration, field trips, current periodicals and selected readings, the student will explore the Chinese way of being, thinking and living. Emphasis is placed on artistic contributions (martial, culinary, painting and calligraphy) and languages of China to the Western World. 3 credits.

### **54.101 Beginning Spanish I**

Provides instruction in the development of fundamental skills in oral expression, aural comprehension, reading and writing. Tapes available for laboratory use. Students who have completed more than one year of Spanish at the secondary level are ineligible for this course. 3 credits.



### **54.102 Beginning Spanish II**

Serves as a continuation of 54.101, which is a prerequisite. 3 credits.

### **54.211 Intermediate Conversational Spanish I**

Reviews Spanish grammar and syntax with emphasis upon increased proficiency in aural comprehension and oral expression. This course is intended for students who have completed two years of high school Spanish, preferably during their junior and senior years, or for students who have completed 54.102. 3 credits. Area II core course.

### **54.212 Intermediate Conversational Spanish II**

Serves as a continuation of 54.211, which is a prerequisite, with emphasis upon continued development of comprehension and conversational skills. 3 credits. Area II core course.

### **54.245 Advanced Spanish Conversation**

Covers advanced oral fluency in rapid and idiomatic speech. Topics of contemporary significance will be selected from contemporary prose. 3 credits.

### **54.254 Topics in Conversational Spanish**

Discusses a wide spectrum of contemporary topics with the object of continuing to develop facility and accuracy of expression. 3 credits. Prerequisite: advanced level proficiency.

# Management

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## **69.201 Principles of Management**

Introduces the principles of management, including the functions of planning, directing, organizing and control in relation to business. 3 credits.

## **69.221 Marketing Principles**

Studies product planning, distribution, promotion and pricing in the context of consumer behavior, governmental constraints and the structure of business institutions. 3 credits. Prerequisite: 68.201.

## **69.226 Sales Management**

Discusses management of the personal selling function. Principles of sales force organization, selection, training, compensation, supervision and motivation are explored via appropriate cases. 3 credits. Prerequisite: 69.221.

## **69.231 Business Finance**

Presents the principles of financial management, including working and fixed capital sources of funds, financial statements, budgeting and capitalization. 3 credits. Prerequisites: 67.102, 68.201, 68.202.

## **69.232 Money and Banking**

Discusses the evolution of money and credit and their role in the economy. Monetary policy and the Federal Reserve System will be covered. Structure and function of the commercial banking system and the role of other financial institutions are also discussed. 3 credits. Prerequisites: 68.201, 68.202.

## **69.234 Investment Management**

Presents the principles of investment: security analysis, portfolio management and market analysis. 3 credits. Prerequisite: 69.231.

## **69.241 Statistics for Business**

Covers descriptive statistics, sophisticated counting techniques and other components of probability, simple random variables and their distributions, bivariate functions, sampling theory, properties of estimators, confidence intervals and hypothesis testing. 3 credits. Prerequisite: 90.112 or 90.113. May not also take 92.183.

## **69.251 Personnel Management**

Discusses recruitment, selection and training of the work force. Wage and salary administration, employee health and safety, welfare and education are all covered. 3 credits. Prerequisite: 69.201.

## **69.253 Organizational Behavior**

Presents applications of concepts from the behavioral sciences to individual and group activity in organizations. Use of behavioral concepts to introduce and implement organizational change will be discussed. 3 credits. Prerequisite: 47.101.

## **69.262 Business Law I**

Discusses the principles of commercial law encompassing a study of contracts, agency, employment, commercial paper and sales including the Uniform Commercial Code. 3 credits.

## **69.263 Business Law II**

Provides an analysis of the legal principles underlying real and personal property, corporations, partnerships, trusts and estates. 3 credits. Prerequisite: 69.262.

### **69.271 Operations Management**

Presents the principle of production/operations management. Nature and function of production systems, operation planning and control, plant layout, materials handling, inventory and quality control are all covered. 3 credits. Prerequisite: 69.241.

## **Mathematics**

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All mathematics courses, including those designated as Computer Mathematics. Option courses except 90.010 and 90.111 are transferable to the University of Lowell day division upon appropriate University approval. Courses with the prefix 92 are equivalent to those in the day school with the same number. Day school students wishing to elect courses with the prefix 90 must consult the Chairperson and/or Coordinator in order to determine course equivalence.

### **90.010 Introductory Mathematics**

Serves as a transitional course designed for students with a limited mathematics background. The main purpose of this course is to give students an insight into the structure of basic mathematics, including algebra, and to increase the students' manipulative skills in this area. 3 credits.

### **90.111 Fundamentals of Algebra**

Intended for students with little or no background in basic algebra or whose background is not current. Topics covered include: the real number system, factoring fractions, linear equations, functions, graphs, systems of equations, and the quadratic equation. 3 credits.

**Note:** 90.010 and 90.111 may not be used as electives in any University degree programs.

### **90.112 Concepts in Algebra I**

Designed for students whose background in basic algebra is current. The emphasis is on applications to the management and social sciences. Topics covered include: an introduction to set notation, equations, inequalities, functions, and matrices. Credit is not given for both 90.112 and 92.121. 3 credits. Prerequisite: 90.111 or satisfactory score on the Math Placement Exam given the first week of class.

### **90.119 Concepts in Algebra II**

Serves as a continuation of 90.112. Topics covered include quadratic functions, the mathematics of finance, linear programming, optimization and an introduction to differential calculus. 3 credits. Prerequisite: 90.112.



**92.115 College Trigonometry**

Covers angles and their measure, the trigonometric functions, solving triangles, law of sines, law of cosines, circular functions and their graphs, and trigonometric identities. 3 credits. Prerequisite: 92.121.

**92.121 Precalculus Mathematics**

Intended for students whose background in basic algebra is current. The course objective is to provide students with the problem solving and computational techniques needed for further coursework and in their occupation. Topics covered include: quadratic equations, functions, transformations, inequalities, systems of equations, and the exponential and logarithmic functions. Credit is not given for both 92.121 and 90.112. 3 credits. Prerequisite: 90.111 or satisfactory score on the Math Placement Exam given the first week of class.

**92.125 Calculus A**

Serves as a first course in calculus and provides a brief review of analytic geometry and trigonometry. The course progresses to the study of limits, derivatives, rules for differentiation of algebraic and transcendental function, chain rule, implicit differentiation, continuity, related rate problems, max. min problems, and curve sketching. 3 credits. Prerequisite: 92.115.

**92.126 Calculus B**

Serves as a continuation of 92.125. The course covers integration, rectilinear motion, sigma notation, area, area between two curves, volumes by disc and shell methods, length of a plane curve and surface area, natural logarithm, the exponential function, hyperbolic functions, inverse functions and inverse trigonometric functions, integrals and derivatives of the inverse trig. functions, and integration formulas. 3 credits. Prerequisite: 92.125.

**92.183 Introduction to Statistics**

Covers sets and probability laws, random variables, mathematical expectations, measure of central tendency and variance. Study of discrete and continuous probability distribution, sampling theory, and tests of hypothesis are also included. Regression and correlation will also be covered. Students who wish a more detailed development of statistics and probability are advised to take the sequence 92.307, 92.308. 3 credits. May not be taken for credit along with 92.386 or 69.241. Area III core course.

**92.221 Linear Algebra I**

Provides an introduction to sets and mathematical logic. The basic properties of linear mappings, matrices, scalar products and orthogonality, and systems of linear equations are covered. Applications of the above will also be discussed. 3 credits. Prerequisite: 92.225 and 92.321 or permission of Coordinator.

**92.222 Linear Algebra II**

Covers matrices and bilinear forms; symmetric, hermitian and unitary operators; eigenvectors and eigenvalues; and the Caley Hamilton, Sylvester and Spectral Theorems. Applications of the above are discussed. 3 credits. Prerequisite: 92.221.

**92.223 Survey of Calculus**

Surveys the basic concepts in differential and integral calculus. Topics included are techniques of differentiation and integration and applications. This is a one semester course intended to provide a broad appreciation of the topics ordinarily covered in the first two semesters of a calculus course. This course may not be used to replace any required calculus course. 3 credits. Prerequisite: 92.121.

**92.225 Calculus C**

Provides a continuation of 92.126. This course covers integration by parts, integration of trigonometric integrals, trigonometric substitution, partial fraction, numeric integration, improper integrals, L'Hopital's Rule, indeterminate forms, sequences, infinite series, integral test, comparison tests, alternating series tests, power series, Taylor series, polar coordinates, graphs and areas in polar coordinates, and parametric equations. 3 credits. Prerequisite: 92.126.

**92.226 Calculus D**

Serves as a continuation of 92.225. This course covers vector calculus, curvature, cylindrical surfaces, dot and cross products, curves and planes in three space, cylindrical and spherical coordinates, functions of two variables, chain rule, directional derivatives and gradient, tangent planes and functions of  $n$  variables, a double and triple integrals in rectangular, polar, cylindrical and spherical coordinate systems. 3 credits. Prerequisite: 92.225.

**92.234 Differential Equations**

Presents ordinary differential equations including equations of order one, linear differential equations, non-homogeneous equations, method of undetermined coefficients, the Laplace transform, systems of equations, electric circuits and network, existence and uniqueness of solutions, and nonlinear equations. 3 credits. Prerequisite: 92.225.

**92.301 Introduction to Applied Mathematics I**

Discusses matrices, vector analysis, review of vector algebra, vector calculus, and divergence theorem. Green's theorem and Stokes' theorem will also be covered. 3 credits. Prerequisite: 92.226

**92.302 Introduction to Applied Mathematics II**

Covers series solutions of ordinary differential equations. Bessel functions, Legendre functions, ordinary differential equations, and boundary value problems are all discussed. Fourier series and integrals, partial differential equations of physics and engineering, and separation of variables will also be addressed. 3 credits. Prerequisite: 92.234.

### **92.305 Introduction to Real Analysis I**

Presents some set theory including equivalence and countability. This course also provides an axiomatic introduction to the real number system. Sequences of real numbers including boundedness, monotonicity, convergence, and divergence will be discussed. Series of real numbers including convergence, divergence, absolute convergence are also presented. Limits and continuity of real functions of a real variable are covered. Metric spaces including open sets, closed sets, limits of sequences, limits and continuity of functions, connected sets, compact sets, bounded sets, total bounded sets, completeness, continuous functions on compact sets, the Intermediate Value Theorem, and uniform continuity will also be addressed. 3 credits. Prerequisites: 92.221, 92.225.

### **92.306 Introduction to Real Analysis II**

Presents the calculus of Newton and Leibnitz including the Riemann integral, averages of a function, the derivative, the Fundamental Theorems of Calculus, and the Mean Value Theorem. Sequences and series of real valued functions of a real variable including pointwise convergence, uniform convergence, integration and differentiation are discussed. The Weierstrass Approximation Theorem, the Stone-Weierstrass Approximation Theorem and the Stone-Weierstrass Theorem will be presented. Lebesgue measure including measurable sets, nonmeasurable sets, and measurable functions are discussed. The Lebesgue integral including the Lebesgue Dominated Convergence Theorem, Fatou's Lemma, and the metric space  $L$  are also addressed. 3 credits. Prerequisite: 92.305.

### **92.307 Probability and Mathematical Statistics I**

Presents probability functions and densities, expectations. Moments of probability distributions will also be covered. 3 credits. Prerequisite: 92.226

### **92.308 Probability and Mathematical Statistics II**

Discusses sampling, decision theory, estimation, hypothesis testing, regression and correlation. 3 credits. Prerequisite: 92.307.

### **92.315 Partial Differential Equations I**

Covers basic concepts in partial differentiation. Classifications and solution of first order and higher order linear partial differential equations will be discussed. Introduction to Bessel, Legendre and other orthogonal functions, as well as boundary value problems included application of Fourier Series, Fourier Integrals, and Laplace Transforms will be addressed. 3 credits. Prerequisite: 92.234.

### **92.321 Discrete Structures I**

Discusses propositional logic, connectives, rules of inference, quantifiers. Proofs, proof by contradiction, induction, applications in computer logic and proofs of program correctness are presented. Algebra of sets, relations on sets, equivalence relations, functions, composition, one-to-one and onto will be covered. Directed and undirected graphs, paths, circuits, reachability and connectedness, decision trees, balanced trees, polish notation and trees, graphs scheduling problems, flow in network, data structures are also discussed. Matrices, solution sets for systems of matrix operations are each addressed. 3 credits. Prerequisite: 90.112 or 92.121 or equivalent.

### **92.322 · Discrete Structures II**

Presents algebraic structures, sets with operations, associative, commutative and distributive operations, modular arithmetic, electronic privacy and signature. Groups and semigroups, group axioms, permutation groups, cosets, normal subgroups, sequential machines are discussed. Lattices and Boolean Algebra, switching theory, logic design are covered. Finite fields, representation and structure, minimal and irreducible polynomials, primitive elements, polynomial roots, error-correcting codes, and public security key systems will each be addressed. 3 credits. Prerequisite: 92.321.

### **92.362 Numerical Analysis I**

Presents theory and applications of numerical techniques including: error analysis, non-linear equations, approximation of functions, interpolation of polynomials, and numerical integration. Computer solutions are emphasized. 3 credits. Prerequisites: 92.263, 92.225.

### **92.381 Introduction to Operations Research Techniques I**

Discusses the use of decision models in industrial systems. Fundamentals of probability and matrix theory are presented. Critical path methods. Linear programming, the simplex method, sensitivity analysis, goal programming, transportation and assignment models, and integer programming are covered. 3 credits. Prerequisite: 92.126.

### **92.382 Introduction to Operations Research Techniques II**

Provides a continuation of 92.381. Topics include: inventory control models, Markov analysis, queuing models, dynamic programming, network analysis, and simulation techniques. 3 credits. Prerequisite: 92.381.

### **92.386 Statistics for Science and Engineering**

Serves as a one semester course in probability and statistics with applications in science and engineering. Probability of events, discrete and continuous random variables, density functions, distributions, estimation, hypothesis testing, regression and correlation will be covered. May not be taken for credit along with 92.183 or the sequence 90.241, 90.242. 3 credits. Prerequisite: 92.126.

### **92.401 Applied Mathematics and Modeling**

Studies realistic problems in order to teach students how mathematics can be applied to models and situations existing around us. Examples are population dynamics, traffic flow, epidemics and dynamic problems such as planetary motion and harmonic oscillation. Basic mathematical techniques will be applied, and mathematical models will be "built" to describe particular problem behavior. Solutions can then be interpreted and information can be learned from them. In studying such methods we will expand our knowledge of calculus, linear algebra and differential equations. 3 credits. Prerequisites: 92.226, 92.221 and 92.234.

### **92.411 Complex Variables I**

Presents the following topics: complex numbers, functions of a complex variable, mappings, derivatives, analytic functions, elementary functions, integrals, Laurent series, residues and poles as well as contour integration. 3 credits. Prerequisite: 92.226.



**92.412 Complex Variables II**

Presents the following topics: transformations, conformal mappings, boundary conditions, application in heat conduction, electrostatic potential, and fluid flow. Gamma and beta functions. Inverse Laplace transform and Riemann surfaces will be covered. 3 credits. Prerequisite: 92.411.

**92.421 Abstract Algebra I**

Discusses elementary group theory, groups, cosets, normal subgroups, quotient groups, isomorphisms, homomorphisms, series of groups, the Sylow theorems, free groups and homology groups. 3 credits. Prerequisite: 92.126 and 92.321.

**92.422 Abstract Algebra II**

Covers elementary ring and field theory, quotient rings and ideals, homomorphisms of rings, rings of polynomials, algebraic extensions, automorphisms of fields, separable extensions, Galois Theory and an introduction to categories and functions. 3 credits. Prerequisite: 92.421.

**92.442 Boundary Value Problems**

Discusses the Fourier series as a tool of analysis. Topics to be covered include: orthogonal functions, convergence tests, the Fourier integral, partial differential equations of physics and engineering, and boundary value problems. 3 credits. Prerequisite: 92.306.

**92.454 Numerical Analysis II**

Provides a continuation of 92.362 including numerical solution of ordinary and partial differential equations, boundary value problems, curve-fitting, nonlinear systems of equations, matrices, error analysis and computer solutions. 3 credits. Prerequisite: 92.362.

**92.498 Mathematics Seminar**

Allows for student reading, writing and criticism of topics from current literature. Review of some important elements of undergraduate work. 3 credits. Prerequisite: permission of Coordinator.

## Mechanical Engineering Technology

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**23.101 Engineering Graphics I**

Presents material in both the class and laboratory format, and covers graphical communications, lectures and exercises on the presentation of data and shape, and the description of various mechanical parts. Topics covered include; multi-view sketching and projection, section view, isometric and oblique drawing, dimensioning, and detail drawing. 2 credits.

**23.102 Engineering Graphics II**

Presents material in both the class and laboratory format, serving as a continuation of 23.101. Topics covered include: primary and secondary views; descriptive geometry of lines, points, planes and intersections; tolerancing; details and assembly drawing; and parts listing and symbols. 2 credits. Prerequisite: 23.101.

### **23.200 CADrf (Computer Aided Drafting)**

Presents material in class and laboratory sessions in order to teach the creation of two- and three-dimensional engineering databases using an interactive graphics workstation. Development of mechanical drawings from the standard orthographic and auxiliary views, and modification of lines, arcs, text, dimensions and other geometric entities will be presented. 3 credits. Prerequisites: 23.102, 92.263.

### **23.202 Thermo/Fluids Laboratory**

Presents the fundamentals of measurements in the general areas of thermodynamics and fluid mechanics. Laboratory topics include flow measurement of air and steam, critical flow through an orifice, fluid flow in pipes and pumps, tests of heat exchangers, gas turbines, internal-combustion engines, and refrigeration cycles. 2 credits. Prerequisites: 23.241, 23.242, 42.226.

### **23.221 Statics (MET)**

Discusses the fundamentals of statics. Topics covered include vector algebra, force, resultants, moment of a force, friction, area and mass moment of inertia, and static equilibrium of rigid bodies. 3 credits. Prerequisites: 92.125, 99.131, 92.263.

### **23.222 Dynamics (MET)**

Covers the laws of kinematics of particles and rigid bodies involving absolute and relative motion. Principles of work and energy, impulse and momentum are also addressed. 3 credits. Prerequisites: 92.126, 23.221.

### **23.223 Mechanics of Materials I**

Presents stress and deformation analysis of bodies under axial, torsional, flexural and combined loading. Also covered are principle stresses, Mohr's stress circle, strain, temperature effects, and shear and moment diagrams. 3 credits. Prerequisites: 92.126, 23.221.

### **23.241 Elements of T Thermodynamics I**

Studies the first and second laws as applied to a thermodynamic system. The concepts of heat and work; thermodynamic properties of liquids, vapors, and gases; and perfect gas laws are discussed. The use of thermodynamic tables and charts will also be presented. 3 credits. Prerequisite: 92.126, 99.132, 92.263.

### **23.242 Applied Fluid Mechanics**

Covers the properties of fluids, and basic concepts of continuity, momentum, hydrostatics and fluid flow kinematics. Analysis of flow of real fluids in pipes, ducts and open channels is conducted. Study of compressible flows, fluid couplings and torque converters as well as flow measurement techniques will also be discussed. 3 credits. Prerequisites: 23.222, 92.263.

### **23.243 Elements of Thermodynamics II**

Presents the application of thermodynamic principles. Vapor and gas cycles, refrigeration and energy conversion are covered. The concepts of availability and irreversibility will also be addressed. 3 credits. Prerequisite: 23.241.

**23.295 Materials Science**

Studies the mechanical, electrical, thermal, chemical and magnetic properties of the materials, and the dependency of these properties on the crystal structure and atomic arrangement. Methods of altering the structures of materials to obtain desired properties will also be presented. 3 credits. Prerequisites: 84.121, 99.132.

**23.302 Mechanics/Materials Laboratory**

Presents hands-on experiments that cover statics, dynamics and mechanics of materials. Topics include: concepts of strain gages, tension test, rotating motion, columns and beams, principle of stresses, rigid body dynamics, torsion, surface hardness, and relative motion. 2 credits. Prerequisites: 23.222, 23.223, 42.226.

**23.320 Machine Design**

Presents material in both class and laboratory. Application of theories of failure, mechanics of materials and dynamics to the analysis and design of typical machine elements, such as shafts, springs, screws, belts, pulleys, keys, and gears are covered. Problems assigned also illustrate synthesis of ideas applied to design. 3 credits. Prerequisites: 23.222, 23.223.

**23.354 Problems in Mechanical Engineering Technology**

Provides a review and extension of applied mechanics. Analytical as well as computer aided solution to the problems in statics, dynamics, and machine design will be addressed. 3 credits. Prerequisites: 23.320, 92.225, 92.263.

**23.402 Engineering Measurement Laboratory**

Presents hands-on experiments that are designed to teach the fundamentals of instrumentation devices, experimental techniques and basic physical principles of mechanical systems. The student: 1) assembles measurement systems including transducers, signal conditioners and data acquisition systems; 2) conducts experiments on simple mechanical systems; and 3) validates the data by analyses. Effective written communication techniques are emphasized. 2 credits. Prerequisites: 42.226, 17.132, 23.222, 23.241, 23.242, 92.263.

**23.405 Senior Project**

Involves the application of the student's engineering training to a practical problem. The project is judged based on the planning, executing, oral and written progress report, and final report. Work may be individual or a team effort, depending upon the complexity of the project. 3 credits. Prerequisite: Senior status.

**23.455 Robotics**

Provides a description of robotic systems and their applications. Understanding the basic functions and interactions of robotic subsystems will be encouraged. Students will be expected to perform exercises in programming commercially available robots for classroom demonstrations. Methods for determining the capabilities and limitations of robotic subsystems through analysis and experimentation will also be discussed. 3 credits. Prerequisites: 23.320, 92.263.

### **23.471 Design of Automatic Machinery**

Covers basic concepts in design of automated machinery with emphasis on selection and integration of standard components and controls. Fundamentals of pneumatic, relay and microprocessor controls applied to pneumatic, electro-mechanical and mechanical sensing and actuating components will be presented. 3 credits. Prerequisites: 17.132, 23.320, 92.263.

### **23.472 Applied Dynamics**

Presents statics and dynamics as applied to general systems with oscillatory motion. The kinematics of periodic motion and the vibrations of systems with single degree of freedom will be addressed. 3 credits. Prerequisites: 92.226, 23.222, 23.223.

### **23.473 Mechanics of Materials II**

Discusses topics such as: shear center, unsymmetrical bending, energy methods, unit dummy load method, and failure theories. 3 credits. Prerequisites: 92.226, 23.223.

### **23.475 Heat Transfer**

Studies heat conduction in solids, fluid flow and convective heat transfer, heat exchangers, and heat transmission by radiation. Solutions to problems that arise in practice will be discussed. 3 credits. Prerequisites: 23.241, 23.242, 92.226, 92.263.

### **23.478 Air-Conditioning System**

Presents a short review of thermodynamics and heat transfer, thermodynamic properties of moist air, humidity measurement, psychrometric charts, heating and cooling of moist air, solar radiation calculation, heat transmission in buildings, system evaluation and design. 3 credits. Prerequisites: 23.241, 23.475.

### **23.480 CADES (Computer Aided Design)**

Presents material in both the class and laboratory format. Use of CAD tools for creating, viewing and analyzing mechanical elements will be emphasized. The intent is for students to learn the usefulness of CAD systems as a part of the overall design process — from concept to the final stages of production. Projects required. 3 credits. Prerequisites: 23.200, 23.320, 23.354.

### **23.483 Aerodynamics**

Discusses the fundamentals of subsonic aerodynamics. Topics to be covered include: airfoil data including Mach number and Reynolds number effects, circulation, downwash, wing theory, lift and drag, and aircraft performance calculations. 3 credits. Prerequisites: 23.242, 92.226, 92.263.



## Music

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### **71.100 Basic Music Theory**

Studies the symbolics of music and their application to the comprehension of the architectural and organizational elements of music literature. Open to non-music majors. 3 credits. Area II Core Course.

## Philosophy

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### **45.201 Introduction to Philosophy**

Examines some of the typical approaches to philosophical questioning and the issues raised in such inquiry. Questions such as: what is true knowledge, what is reality, what is the good, what is the right political order, what is the nature of religious faith? 3 credits. Area II core course and Human Values core course.

### **45.202 Introduction to Logic**

Studies the methods used to distinguish correct from incorrect reasoning. This course will aim at developing (1) an ability to express one's ideas clearly and concisely; (2) an increased skill in defining one's terms; and (3) a capacity to formulate arguments vigorously and to scrutinize them critically. 3 credits. Area II core course.

### **45.203 Introduction to Ethics**

Examines the basic issues and problems of ethics and value and a survey of some important alternative answers to the questions raised, on both an individual and a social level, by our necessity to act and to live in a rational and human way. 3 credits. Area II core course and Human Values core course.



## Physics

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### 99.131 Technical Physics I

Presents material in both the class and laboratory format. Topics include: vectors; one- and two-dimensional motion; Newton's laws of motion; translational and rotational equilibrium; work and energy; linear momentum; and circular motion and gravitation. Two Friday night classes will be required. 3 credits. Prerequisites: 92.121, 92.115.

### 99.132 Technical Physics II

Covers material in both the class and laboratory format. Rotational dynamics; mechanical vibrations and waves; sound; solids and fluids; thermal physics; heat and law of thermodynamics will be discussed. One session per week. Two Friday night classes will be required. 3 credits. Prerequisite: 99.131. Corequisite: 92.125.

### 99.133 Technical Physics III

Presents material in both the class and laboratory format. Reflection, refraction, mirrors, lenses, wave optics, optical instruments, Coulomb's law, magnetic force, quantum physics, atomic physics and nuclear physics will each be addressed. One session per week. Two Friday night classes will be required. 3 credits. Prerequisite: 99.132. Corequisite: 92.126.

## Plastics

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### 27.201 Plastics Material Science I (Commodity Thermoplastics)

Presents material in class and demonstration laboratory (as scheduled by the instructor). This is an introductory course reviewing the history, classification, definitions and terminology, raw materials, methods of manufacturing, testing-characterization of typical physical properties, and end-uses of polymeric materials systems. Emphasis will be on the commodity thermoplastics, polyolefins, vinyls and styrenics. 3 credits.

### 27.202 Plastics Material Science II (Engineering Thermoplastics)

Covers material in class and demonstration laboratory (as scheduled by the instructor). This is a continuation of 27.201, emphasizing engineering thermoplastics, nylons and acetals, acrylics and cellulose, polycarbonates, polysulfones, modified PPE, polyesters, fluoropolymers, polyimides, PPS, PEI and LCP's, and recently introduced copolymers, alloys and blends. Discussions will review the chemistry, properties, processability and design limitations of these high performance engineering and specialty polymers. 3 credits. Prerequisite: 27.201.

### **27.203 Plastics Material Science III (Thermosetting Resins)**

Presents material in both class and demonstration laboratory (as scheduled by the instructor). This is an in-depth review of the major families of thermosetting resins: henolics, aminos, polyesters, epoxies, silicones, and various polyurethane systems. Emphasis is on basic chemistry, inherent physical properties and processability, and the effect of incorporating fillers, reinforcements, colorants, lubricants, and other chemical additives in order to engineer-in necessary processing ease, and to meet functional performance end-use demands. 3 credits.

### **27.301 Additives for Polymeric Materials**

Presents an analysis of additives including stabilizers, plasticizers, fillers and reinforcements, biocides, flame retardants, antistatics agents, and release agents. Special emphasis will be placed on the characteristics of each type of additive, compatibility interactions and effects on processing. A review of the most current methods of testing efficiency of each additive system will also be covered. 3 credits.

### **27.303 Reinforced Plastics Composites**

Reviews composites as a class of materials and the mechanical physical characteristics. Topics include fundamental concepts underlying these properties, with particular emphasis on fibrous reinforced plastics. A survey of matrices, reinforcements and methods of fabrication will also be conducted. 3 credits. Prerequisite: 27.202.

### **27.373 Plastics Mold Engineering I**

Covers material in both the class and laboratory. Topics include an introduction to the principles of basic mold and die design and construction. Laboratory design of molds and/or dies to be constructed in continuing portions of this course. Lecture, laboratory and demonstrations at the discretion of the instructor. 3 credits.

### **27.376 Plastics Mold Engineering II**

Serves as a continuation of 27.373. 3 credits.

### **27.401 Processing Technology I**

Presents material in both the class and laboratory. Theory and methods of processing plastics materials including compounding, molding, extruding and thermoforming will be covered. Evaluation and development of typical problems will also be discussed. Laboratory sessions and demonstrations as scheduled by the instructor. 3 credits. Prerequisite: 27.202.

### **27.402 Processing Technology II**

Provides material in both the class and laboratory format, serving as a continuation of 27.401. Discusses casting, laminating, fabricating and finishing, processing and fabricating with product design and applications. Laboratory sessions and demonstrations as scheduled by the instructor. 3 credits. Prerequisite: 27.401.

### **27.403 Physical Properties of Polymers I**

Introduces basic mechanical properties of polymers as linear viscoelastic materials. The concepts of creep, stress relaxation and superposition principles are emphasized. Dynamic mechanical behavior, interrelations between various properties, electrical behavior, miscellaneous mechanical properties and optical properties will also be covered. 3 credits. Prerequisites: 84.223, 84.225, 84.344 and 86.355.

### **27.404 Physical Properties of Polymers II**

Serves as a continuation of 27.403. 3 credits.

### **27.405 Polymer Characterization**

Discusses instrumental methods of characterizing plastics materials. The theory and interpretation of infrared spectroscopy, gas chromatography, gel permeation chromatography, differential thermal analysis, thermal gravimetric analysis, osometry, etc. are covered. The determinations will include elucidation of structure, identification, molecular weight, molecular weight distribution and glass transition temperatures. 3 credits. Prerequisite: 84.122, permission of Coordinator.

### **27.406 Polymer Structures**

Presents the fundamental relationship between molecular structure, properties and end-use applications of plastics materials. Molecular structural features include chemical composition, molecular size and flexibility, intermolecular order and binding, and supermolecular structure. Properties to be covered include processability, mechanical, acoustic, thermal, electrical, optical and chemical properties, price, and balance of properties. Applications to be discussed include rigid solids, flexible solids, foams, film and non-plastic applications. 3 credits. Prerequisite: permission of Coordinator.

### **27.407 Plastics Industry Organization**

Discusses the economics of producing plastics raw materials and converting them into end products, from research and development to plant construction, operation and marketing. Market analysis of plastics production, processing, and consumer patterns: commercial development, sales, and technical service will be addressed. Organization of the plastics industry for research and development, specialty and commodity production, profit and growth will also be presented. 3 credits. Prerequisite: permission of Coordinator.

### **27.408 Adhesives and Adhesions**

Covers adhesive joining of engineering materials. Surface chemistry, theories of adhesion and cohesion, joint design, surface preparation, commercial adhesives, rheology, equipment, testing, service life and reliability. 3 credits. Prerequisites: 84.223, 84.225, 84.344 and 86.355.



**27.409 Coatings Science and Technology I**

Covers polymers, pigments, solvents and additives used in coatings. Methods of polymerization, formulation, application and testing are discussed. Substrates and applications will also be covered. 3 credits. Prerequisites: 84.223 and 84.225.

**27.410 Coatings Science and Technology II**

Serves as a continuation of 27.409. 3 credits.

**27.411 Rheology of Coatings**

Studies rheology of polymer melts, solutions, latexes and pigment dispersions, and their application to coatings and adhesives. 3 credits. Prerequisites: 84.344 and 86.355.

**27.451 Selected Topics in Polymers I**

Covers specialized topics in applied polymer science, adhesives, elastomers, coatings and fibers as well as other timely subjects. 3 credits. Prerequisite: permission of Coordinator.

**27.452 Selected Topics in Polymers II**

Serves as a continuation of 27.451. 3 credits. Prerequisite: 27.451, also permission of Coordinator.

**27.453 Colloids**

Covers colloid chemistry principles, zeta potential and its applications, and specific problems involving surface chemistry and physics. 3 credits. Prerequisites: 84.344 and 86.355.

**27.457 Plastics Coatings in Electronics**

Presents the role of plastics coatings in electronics. Chemical, electrical, thermal, and mechanical characteristics of each major plastics family are covered. Manufacturing technology for applying them will also be addressed. 3 credits. Prerequisites: 84.223, 84.225, 84.344 and 86.355.

## Political Science

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**46.101 Introduction to American Politics**

Provides an introductory analysis of the structures, functions and behavior of the American political community. The analysis will emphasize politics and political behavior at the national level. 3 credits. Area I core course.

**46.121 Introduction to International Relations**

Surveys of some recent methods and approaches used in the study of international politics and provides an introduc-

tion to current problems of foreign policies of major world powers. 3 credits. Area I core course.

**46.230 Law and the Legal System**

Presents an introduction to the nature of the legal process and the operation of the American legal system. Considerations of its political and social functions will also be discussed. 3 credits.

**46.260 Public Administration**

Presents an introductory study of bureaucratic organization and behavior in American society. One session per week. 3 credits.

**46.282 Contemporary Political Theory**

Examines major ideological currents in the contemporary world. Marxism, communism, fascism, anarchism and the relevance of Freud to modern political thought are some of the possible topics for examination. 3 credits. Area I core and Human Values core course.

**46.345 Constitutional Law and Politics**

Presents an advanced study of judicial review and judicial behavior as they have developed through the historical process of constitutional adjudication. Special emphasis is given to the continuing tension between judicial review and American democracy. 3 credits.

**46.347 Civil Liberties, Law, and Politics**

Provides an advanced examination of the developments of American concepts of civil liberty and equal rights through the historical process of constitutional adjudication and in other areas of the law, government, and society. 3 credits

## Psychology

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**47.101 General Psychology**

Serves as a basic introductory course, primarily for non-concentrators, surveying the major areas of psychology, including the nature of psychology as a science, learning, human development and personality, perception and motivation, behavioral disorders, and social behavior. 3 credits. Area I core course.

**47.163 The Human Life Span**

Primarily for non-concentrators, this course surveys the major stages and processes in human development from birth to death. 3 credits. Area I core course.

**47.209 Social Psychology**

Presents an introduction to the study of social behavior in interpersonal relationships, groups, organizations and the community. Topics include attitudes and attitude change, group dynamics, leadership and interpersonal influences. 3 credits. Area I core course and Human Values core course.

**47.232 Psychology of Personality**

Surveys the major theories of personality, beginning with Freud and psychoanalysis, the neo-Freudians, existential psychology, humanistic theories of Rogers and Maslow, and behavioristic and social learning theories. The interplay between theory and research is also considered. 3 credits. Area I core course.

**47.255 Community Psychology**

Surveys the nature and practice of community psychology, including principles of community organization and change as seen in such areas as education, mental health, corrections and social services. Students will participate in field research or practice under the direction of an assigned agency, and classroom work will include discussion of the field experiences of the participants. 3 credits. Area I core course.

**47.260 Human Development I**

Begins with an overview of major theoretical perspectives, research methods and ethical issues in life-span human development. Based on a chronological approach, the course covers prenatal development and birth, infancy, childhood and adolescence, and the transition to adulthood. This course will be offered beginning Fall 1991. 3 credits.

**47.261 Child Psychology**

Introduces theory and research in the field of child psychology. Using a chronological approach, the course covers the concepts and processes of child development. 3 credits.

**47.262 Adolescent Psychology**

Examines developmental issues during adolescence, including personality development and the emergence of identity, peer relations, the development of moral values and sources of maladjustment. 3 credits. Area I core course.

**47.272 Abnormal Psychology**

Presents an introduction to the study of various patterns of neurotic, psychotic and character disorders. Therapeutic techniques and other auxiliary methods for the treatment of such disorders are studied in relation to contemporary theory and research. 3 credits. Prerequisite: 47.101. Area I core course.

**47.276 Theories of Learning**

Traces the development of theories of learning from earlier global theories to more recent and more specific ones. Behavioral, cognitive and physiological approaches will be compared. Current issues of importance in the study of learning will also be stressed. 3 credits.

**47.328 Dynamics of Interpersonal Relations**

Presents an analysis of psychological dynamics in interpersonal behavior, emphasizing such topics as conformity, leadership, interpersonal growth, self-disclosure, personal styles of interaction and technique of change. The primary focus will be on the behavior of the students themselves, who form a small group in which they are expected to participate. The course is taught without a formal prerequisite, but students should have some previous course work in psychology. 3 credits. Area I core course.

**47.335 Psychology of Women**

Considers such topics as: the psychology of sex differences; sex roles and socialization; sex stereotypes and attitudes toward women; women's self-concept and achievement; biological basis of psychological sex differences; the nature of female sexuality; clinical theory and practice concerning women; women as mental patients and mental health consumers; and implications for psychology and for women's status. 3 credits. Area I Core course.

#### **47.352 Psychological Tests and Measurement**

Surveys several major tests used to assess such factors as mental abilities, vocational interest, attitudes and personality. Students learn to administer, score and interpret specific tests and the ways in which information is compiled to complete a case study of individuals tested. 3 credits.

#### **47.360 Human Development II**

Begins with an overview of recent theoretical perspectives on adult development and aging. It presents, in chronological sequence, the stages of adulthood and concludes with death and dying. Topics covered include personal, family and vocational development through adulthood; gender pattern differences; and the impact of changing demographics, including the lengthening of the life span. This course will be offered beginning Fall 1991. 3 credits. Prerequisite: 47.260.

#### **47.361 Problems and Issues in Childhood and Adolescence**

Examines specific disorders occurring during childhood and adolescence, including neurotic disorders, autism and psychoses, retardation and learning disabilities, and conduct disorders. Consideration will also be given to developing an understanding of how parent/child interactions may impair healthy development. (e.g. child abuse, neglect, parental alcohol and substance abuse) This course will be offered beginning Fall 1991. 3 credits. Prerequisites: 47.101, 47.260.

#### **47.362 Human Development: Theories, Ethics and Research Strategies**

Examines some of the major theories, research methodologies and ethical considerations in the study of human development. Utilizing a life span approach and building on the introductory courses in life span developmental psychology, this course focuses upon an analysis of major theoretical perspectives and relevant research. This course will replace 47.261 and 47.262. 3 credits. Prerequisites: 47.260.

#### **47.364 Psychology of Crime and Corrections**

Investigates the psychological aspects of crime and deviance, and the nature of punishment and rehabilitation. Clinical case histories or criminal personalities will be combined with experimental studies of anti-social and violent behavior. The nature of prisons and criminal justice will be examined. 3 credits. Prerequisite: 47.272. Area I core course.

#### **47.373 The Biology of Behavior**

Surveys issues and topics dealing with the physiological and evolutionary bases of behavior. Biological systems and processes that influence behavior are considered, with particular emphasis on brain mechanisms. Recent discoveries in the neurosciences will be presented. Methods of research are reviewed. 3 credits. Prerequisite: 47.101.

#### **47.473 Seminar in Social Psychology**

Presents an intensive study of one or more of the following special topics in social psychology: psychology of the family and parent-child relations; oral development; adjustment during adulthood; death and dying; etc. 3 credits. Prerequisites: 47.101 and permission of the instructor.



#### **47.474 Seminar in Developmental Psychology**

Presents a careful consideration of selected topics in the area of human development, including the following: psychology of the family and parent-child relations; infant development; adjustment during adulthood; and death and dying, etc. 3 credits. Prerequisite: 47.101 and permission of the instructor.

#### **47.475 Seminar in Clinical Psychology**

Focuses on such topics as: the nature of psychotherapy and clinical practice; analysis of specific clinical theories of psychopathology and psychotherapy (transactional analysis, Gestalt, psychoanalysis); the nature and causes of specific psychological disorders (schizophrenia, affective disorders, etc.); the nature of mental hospitals; the community mental health movement; clinical methods of assessment; and current topics in personality theory and research, etc. 3 credits. Prerequisite: 47.101 and permission of the instructor.

#### **47.477 Seminar: Contemporary Trends in Psychology**

Offered from time to time, dealing with issues in contemporary areas of psychological practice and/or research; implications for future developments in the field will be covered. 3 credits. Prerequisite: 47.101. Other prerequisites may be specified by the instructor.



## **Sociology**

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#### **48.101 Introduction to Sociology**

Serves as the basic course in sociology. Emphasis is directed at the ways in which social institutions such as government, schools, the economy, social class and the family develop and influence our lives. It is concerned not only with presenting various ways to understand our relationship to society, but also with ways to change it. 3 credits. Area I core course.

#### **48.220 Self Assessment and Career Development**

Studies the meaning of work in our society. Class participants will assess their own life experiences and develop plans to integrate interests, values and abilities into meaningful and realistic life/work options. 3 credits.

**48.231 Sociology of the Family**

Studies the nature of the family in contemporary society, with particular emphasis on the family in America. What functions does the family perform in modern society? How is it changing? How do these changes affect our lives? 3 credits. Area I core course.

**48.241 Sociology of Women**

The women's movement has changed our accepted views of women and men. This course will seek an understanding of the positions of women and men in culture, the economy, the family and political life. Crucial are the questions: "What do we want?" and "What do we need?" Specific topics will be examined. 3 credits. Area I core course and Human Values core course.

**48.255 Social Deviance**

Presents an analysis of behavior considered deviant, such as drug abuse, crime and mental disorders. Attention is paid to cultural definitions of deviance and to social institutions that treat people defined as deviant. 3 credits.

**48.260 Mass Media and Communications**

Investigates the structure of mass communications and the impact of the media on our lives. A full range of media are considered, including television, radio, cinema and the press. The potential impact of new media sources such as cable TV are also considered. 3 credits.

**48.361 Sociology of Law and the Criminal Justice System**

Presents an introduction to the theory, structure, ideology and practice of the criminal justice system. Particular attention is directed at the definition of crime and the impact of social, political and economics policy on the operation of systems and their impact on its "clients". 3 credits. Prerequisite: 48.101. Area I core course.

## Technical Communications

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**42.401 Principles of Technical Writing**

Covers the fundamental concepts and principles of technical writing, including technical description, audience analysis, editing, document specifications and outlines, graphics, definitions, and revising documents. Writing assignments include preparing a document specification, editing and creating graphics. 3 credits.

**42.402 Software Writing**

Covers the document preparation process from start to finish, focusing on each stage in the process. Includes document design, document organization, using examples and illustrations, style, creating an index and the review process. 3 credits.

**42.403 Advanced Software Writing**  
Introduces a range of advanced topics in software writing. Topics may include electronic publishing, hypertext, advanced graphics, document set components and working in project teams. In this course, the student selects some aspect of the computer industry that interests him/her and documents it. 3 credits.

**42.404 Marketing Writing**  
Teaches the student how to write promotional materials such as brochures, press releases, data sheets and new product announcements. The student also learns how to give demonstrations and use interviews to gather information. This course focuses on understanding computer culture with on-site visits and guest lectures. Assignments include preparation of a brochure and other promotional materials. 3 credits.

**90.220 Introduction to Basic Computer Architecture**  
Provides an overview of basic computer architecture with an emphasis on developing computer literacy through explanations of fundamental terms and concepts. Hardware and software topics to be covered include: memory, micro-processors, processing unit, I/O devices, operating system, languages and compiler, and user interfaces and application. Students are expected to write simple programs in Basic. 3 credits. Prerequisites: 92.209 or 92.219.

**92.265 Pascal Programming**  
Presents an introduction to computer programming including the elements of algorithm design and data structures. The Pascal language will be used. Topics covered include: algorithm development by step-wise refinement; language control structures; functions and procedures; the standard data types; scalar data types; and an introduction to structured types. The student will process a number of programs on the University computer. 3 credits. Prerequisite: 92.263. Area III core course.

**92.364 Problem Solving with Pascal**  
Designed as a practical problem-solving course, to give students further exposure to the topics covered in 92.265 and to provide the tools needed for software development. The course emphasizes these aspects of the programming problem-solving process: problem specification and organization; algorithms, coding, and debugging; the elements of good programming style; and the means of producing a high-quality finished product. Programming examples are chosen to span a wide range of both numeric and non-numeric applications. 3 credits. Prerequisite: 92.265.

**92.474 Data Base Concepts**  
Introduces data base directives, design elements of 3 data bases, architectures and commercial data bases. Students will participate in the design of a large-scale data base application. Administration of the data base is also covered. Students will program the basic concepts on a machine. 3 credits. Prerequisites: 2 semesters of higher level language, excluding Basic.

**Students may petition to substitute one year of Cobol, Fortran, or C programming language for the preferred Pascal.**

## Work Environment

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### 19.401 Occupational Health

Introduces students to chemical, physical and ergonomic hazards in work environments, and the role that engineers and other professionals can play in protecting the health of the workforce. Through a series of lectures and case studies, examples of the risks of work in modern manufacturing and service occupations are presented. Students work in small groups to apply basic principles of hazard identification and control. The social and economic complexities of the workplace are also explored as they influence the solution to technical problems. 3 credits.





# Degree Requirements

## College of Arts and Sciences

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Peter Blewett, Co-Dean; A.B., A.M., Ph.D.

Arthur C. Watterson, Co-Dean; B.S., Ph.D.

Richard L. Derry, Assistant Dean; A.B., A.M.

Raymond Hardy, Assistant Dean; B.S., M.S.

Philip S. Lamprey, Chemistry Coordinator, B.S., Ph.D.

Donald R. Berry, Liberal Arts Coordinator; A.B., M.A.

Ann Marie Hurley, Computer Mathematics/Information Systems Coordinator;  
B.S., M.S.

Alan W. Doerr, Mathematics Coordinator; B.A., M.A.

The College of Arts and Sciences offers the following Continuing Education undergraduate programs:

### Associate of Science:

Applied Chemistry

Information Systems

Applied Mathematics

Applied Mathematics: Computer Mathematics Option

Public Service: Administration of Criminal Justice

### Bachelor of Liberal Arts in the Social Sciences and History

Concentrations in History, Political Science, Psychology, Sociology

### Bachelor of Science:

Applied Chemistry

Applied Chemistry: Coatings Option

Information Systems

Applied Mathematics

Applied Mathematics: Computer Mathematics Option

Public Service: Administration of Criminal Justice

### Certificate Programs:

Computer Proficiency

Industrial Security Management

Technical Communications

# Applied Chemistry

Associate of Science and Bachelor of Science Degrees

Years 1 - 4 Leading to the Degree of Associate of Science: 64 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
84.121	Chemistry I	3	84.122	Chemistry II	3
92.121	Precalculus Mathematics	3	92.115	College Trigonometry	3
42.101	College Writing I	<u>3</u>	42.102	College Writing II	<u>3</u>
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
86.121	Analytical Chemistry A	3	86.122	Analytical Chemistry B	3
92.125	Calculus A	3	92.126	Calculus B	3
99.131	Technical Physics I	<u>3</u>	99.132	Technical Physics II	<u>3</u>
		9			9

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
84.223	Principles of Organic Chemistry I	3	84.224	Principles of Organic Chemistry II	3
84.225	Principles of Organic Chemistry Lab I	1	84.226	Principles of Organic Chemistry Lab II	1
20.356	Hazardous Waste Management	<u>3</u>	99.133	Technical Physics III	<u>3</u>
		7			7

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
84.344	Physical Chemistry I	3	84.345	Physical Chemistry II	3
86.355	Experimental Physical Chemistry	1	84.347	Physical Chemistry Laboratory II	1
-----	Elective	<u>3</u>	-----	Elective	<u>3</u>
		7			7

This course outline which lists 3 courses each semester is only a suggested course load. First year students should not take more than 1 or 2 courses their first semester. Subsequent course loads may be determined by the students' own personal time constraints.

Years 5 - 8 Leading to the Degree of Bachelor of Science: 135 Credits

Suggested Course of Study

First Semester (September)

Second Semester (January)

**Fifth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
84.334	Advanced Inorganic Chemistry	3	86.352	Chemical Applications	3
92.386	Statistics for Science and Engineering	3	-----	Computer Elective*	3
42.226	Technical and Scientific Communication	<u>3</u>	-----	Area II Elective	<u>3</u>
		9			9

**Sixth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
86.361	Advanced Organic Chemistry I	3	86.362	Advanced Organic Chemistry II	3
27.201	Plastics Materials Science I	3	23.295	Materials Science	3
-----	Area II Elective	<u>3</u>	-----	Elective	<u>3</u>
		9			9

**Seventh Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
86.471	Industrial Chemistry	3	84.314	Analytical Chemistry II	3
68.201	Economics I (Microeconomics)	3	84.316	Analytical Chemistry Lab II	2
-----	Area I or II Elective	<u>3</u>	68.202	Economics II (Macroeconomics)	<u>3</u>
		9			8

**Eighth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
86.481	Chemistry of High Polymers I	3	86.482	Chemistry of High Polymers II	3
-----	Elective	3	-----	Human Values Elective	3
-----	Elective	<u>3</u>	-----	Elective	<u>3</u>
		9			9

\* An introductory computer course in a programming language other than COBOL.

All electives must be approved by the Program Coordinator.

## Applied Chemistry: Coatings Option

### Bachelor of Science Degree

The requirements for this program are those of the Bachelor of Science Program in Applied Chemistry with five of the elective courses being selected from the list below and other relevant courses approved by the program coordinator.

<u>No.</u>	<u>Title</u>	<u>Credits</u>
27.403	Physical Properties of Polymers I	3
27.408	Adhesives and Adhesions	3
27.409	Coatings Science and Technology I	3
27.410	Coatings Science and Technology II	3
27.411	Rheology of Coatings	3
27.453	Colloids	3
27.457	Plastics Coatings in Electronics	3





# Applied Mathematics

Associate of Science and Bachelor of Science Degrees

Years 1 - 4 Leading to the Degree of Associate of Science: 72 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
68.201	Economics I (Microeconomics)	3	68.202	Economics II (Macroeconomics)	3
92.121	Precalculus Mathematics	3	92.115	College Trigonometry	3
42.101	College Writing I	<u>3</u>	42.102	College Writing II	<u>3</u>
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
42.226	Technical and Scientific Communication	3	-----	Area I or II Elective	3
92.125	Calculus A	3	92.126	Calculus B	3
99.131	Technical Physics I	<u>3</u>	99.132	Technical Physics II	<u>3</u>
		9			9

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.225	Calculus C	3	92.226	Calculus D	3
92.386	Statistics for Science and Engineering	3	92.321	Discrete Structures I	3
-----	Area II Elective	<u>3</u>	-----	Human Values Elective	<u>3</u>
		9			9

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
84.121	Chemistry I	3	84.122	Chemistry II	3
92.221	Linear Algebra I	3	92.222	Linear Algebra II	3
92.265	Pascal Programming	<u>3</u>	-----	Computer Elective (92.364 Strongly Recommended)	<u>3</u>
		9			9

This course outline which lists 3 courses each semester is only a suggested course load. First year students should not take more than 1 or 2 courses their first semester. Subsequent course loads may be determined by the students' own personal time constraints.

Years 5 - 8 Leading to the Degree of Bachelor of Science: 135 Credits

Suggested Course of Study

First Semester (September)

Second Semester (January)

**Fifth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.234	Differential Equations	3	-----	Mathematics Elective	3
92.360	Intro. to Data Structures	3	-----	Area II Elective	3
-----	Technical Elective	<u>3</u>	-----	Computer Elective	<u>3</u>
		9			9

**Sixth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.362	Numerical Analysis I	3	92.454	Numerical Analysis II	3
92.301	Introduction to Applied Mathematics I	3	92.302	Introduction to Applied Mathematics II	3
92.455	Assembly Language * Programming I	<u>3</u>	92.462	Systems Programming *	<u>3</u>
		9			9

**Seventh Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
-----	Computer Elective *	3	-----	Computer Elective *	3
-----	Mathematics Elective	3	-----	Mathematics Elective	3
-----	Technical Elective	<u>3</u>	-----	Technical Elective	<u>3</u>
		9			9

**Eighth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>
-----	Computer Elective*	3
92.411	Complex Variables I	3
-----	Technical Elective	<u>3</u>
		9

\* The above courses may be replaced by a sequence of related courses approved by the Program Coordinator.

All electives must be approved by the Program Coordinator.

Many 500-level mathematics courses are within the grasp of upper level undergraduate students. Refer to the day school schedule of classes for graduate course listings. Many graduate courses are offered in the late afternoon/early evening time frame.

# Applied Mathematics: Computer Mathematics Option

Associate of Science and Bachelor of Science Programs

Years 1 - 4 Leading to the Degree of Associate of Science: 72 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.202	Microcomputers and Applications Software	3	92.263	FORTTRAN Programming	3
92.121	Precalculus Mathematics	3	92.115	College Trigonometry	3
42.101	College Writing I	<u>3</u>	42.102	College Writing II	<u>3</u>
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
68.201	Economics I (Microeconomics)	3	68.202	Economics II (Macroeconomics)	3
92.125	Calculus A	3	92.126	Calculus B	3
92.265	Pascal Programming	<u>3</u>	-----	Computer Elective (92.364 is strongly recommended)	<u>3</u>
		9			9

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.463	Systems Design and Development I	3	92.464	Systems Design and Development II	3
92.225	Calculus C	3	92.226	Calculus D	3
92.386	Statistics for Science and Engineering	<u>3</u>	99.131	Technical Physics I	<u>3</u>
		9			9

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.461	Systems Simulation and Modeling	3	92.360	Introduction to Data Structures	3
99.132	Technical Physics II	3	-----	Area I or II Elective	3
92.321	Discrete Structures I	<u>3</u>	42.226	Technical and Scientific Communications	<u>3</u>
		9			9

This course outline which lists 3 courses each semester is only a suggested course load. First year students should not take more than 1 or 2 courses their first semester. Subsequent course loads may be determined by the students' own personal time constraints.



Years 5 - 8 Leading to the Degree of Bachelor of Science: 135 Credits

### Suggested Course of Study

First Semester (September)

Second Semester (January)

#### Fifth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.234	Differential Equations	3	92.455	Assembly Language Programming I	3
-----	Area I Elective	3	-----	Area II Elective	3
92.221	Linear Algebra I	<u>3</u>	92.222	Linear Algebra II	<u>3</u>
		9			9

#### Sixth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.362	Numerical Analysis I	3	92.454	Numerical Analysis II	3
92.301	Introduction to Applied Mathematics I	3	92.302	Introduction to Applied Mathematics II	3
84.121	Chemistry I *	<u>3</u>	84.122	Chemistry II *	<u>3</u>
		9			9

#### Seventh Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
-----	Computer Elective	3	-----	Computer Elective	3
92.462	Systems Programming	3	-----	Mathematics Elective	3
-----	Technical Elective	<u>3</u>	-----	Human Values Elective	<u>3</u>
		9			9

#### Eighth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>
-----	Computer Elective	3
92.411	Complex Variables I	3
-----	Technical Elective	<u>3</u>
		9

\* The above courses may be replaced by a sequence of related courses approved by the Program Coordinator.

All electives must be approved by the Program Coordinator.

Many 500-level mathematics courses are within the grasp of upper level undergraduate students. Refer to the day school schedule of classes for graduate course listings. Many graduate courses are offered in the late afternoon/early evening time frame.

# Information Systems

Associate of Science and Bachelor of Science Degrees  
Associate of Science Degree Requirements: 72 Credits

## Suggested Course of Study

### First Semester (September)

### Second Semester (January)

#### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.202	Microcomputers and Applications Software	3	92.263	FORTTRAN Programming	3
42.101	College Writing I	3	42.102	College Writing II	3
90.112	Concepts in Algebra I	<u>3</u>	90.119	Concepts in Algebra II	<u>3</u>
		9			9

#### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
67.101	Accounting Principles I	3	67.102	Accounting Principles II	3
42.224	Business Writing	3	69.201	Princ. of Management	3
92.365	COBOL Programming I	<u>3</u>	92.368	COBOL Programming II	<u>3</u>
		9			9

#### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.265	Pascal Programming	3	-----	Computer Elective	3
68.201	Economics I (Microeconomics)	3		(92.364 is strongly recommended)	
69.231	Business Finance	<u>3</u>	68.202	Economics II (Macroeconomics)	3
		9	-----	Management Elective	<u>3</u>
					9

#### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.183	Introduction to Statistics	3	92.360	Introduction to Data Structures	3
-----	Area II Elective	3	-----	Management Elective	3
92.321	Discrete Structures I	<u>3</u>	-----	Elective	<u>3</u>
		9			9

This outline which lists 3 courses each semester is only a suggested course load. First year students should not take more than 1 or 2 courses their first semester. Subsequent course loads may be determined by the students' personal time constraints.

**Note:** Students transferring to this program with an Associate degree in Accounting or Banking may substitute their accounting or banking courses for the management electives listed above.

Bachelor of Science Degree: 127 Credits

A. Required Arts and Sciences Courses: 33 credits

- \*42.101 College Writing I
- \*42.102 College Writing II
- \*42.224 Business Writing
- 47.101 General Psychology
- 48.101 Introduction to Sociology
- \*90.112 Concepts in Algebra I
- \*90.119 Concepts in Algebra II
- \*92.321 Discrete Structures I
- \*68.201 Economics I (Microeconomics)
- \*68.202 Economics II (Macroeconomics)
- 92.183 Introduction to Statistics

B. Required Business Courses: 12 credits

- \*67.101 Accounting Principles I
- \*67.102 Accounting Principles II
- \*69.231 Business Finance
- \*69.201 Principles of Management

C. Required Computer Mathematics Option Courses: 36 credits

- \*92.202 Microcomputers & Applications Software
- \*92.263 FORTRAN Programming
- \*92.265 Pascal Programming
- \*92.360 Introduction to Data Structures
- \*92.365 COBOL Programming I
- \*92.368 COBOL Programming II
- 92.455 Assembly Language Programming I
- 92.462 Systems Programming
- 92.474 Data Base Concepts
- 92.477 Information Systems I
- 92.478 Information Systems II
- Computer Elective

\* Courses fulfilling associate's degree requirements.

D. Management, Accounting or Banking concentration: 18 elective credits

Concentration in other areas may be chosen with the approval of the Program Coordinator.

E. University Core Requirements

Human Values:	3 credits
Area II Electives:	6 credits
Science Electives:	4 credits
Free Electives:	<u>15 credits</u>
	28 credits

# Public Service: Administration of Criminal Justice

Associate of Science: 61 credits

A. General University Requirements:	34 credits
B. Criminal Justice Requirements (asterisked):	18 credits
C. Free Electives (with permission of coordinator):	9 credits

Bachelor of Science: 121 credits

(suggested Enforcement, Corrections, or Law and the Courts Tracks)

A. General University Requirements	Total: 34 credits
42.101 College Writing I	3 credits
42.102 College Writing II	3 credits
Area I Electives**	9 credits
** Must include:	
47.101 General Psychology AND	
48.101 Introduction to Sociology	
Area II Electives	9 credits
Area III Electives	10 credits
B. Criminal Justice Requirements	Total: 36 - 48 credits

There are three main areas of tracks which a student may elect: Enforcement, Law and the Courts, or Corrections. Courses suggested for one track are not exclusive, and some crossover is desirable.

## Enforcement

*+44.101	The Criminal Justice System
*44.141	Police Functions: Theory and Applications
*+44.221	Criminology I
+44.234	Criminal Law
*44.243	Criminalistics I
44.244	Criminalistics II
*44.261	Juvenile Delinquency
44.341	Comparative Police Systems
44.370	Criminal Justice Management
44.371	Criminal Justice Planning and Evaluation
44.373	Issues in Police Administration
+44.390	Introduction to Criminal Justice Research
+44.490	Criminal Justice Research Seminar
+44.496	Practicum (In-service students will substitute 44.370 or 44.371)



## Law and the Courts

*+44.101	The Criminal Justice System
*+44.221	Criminology I
46.230	Law and the Legal System
*+44.234	Criminal Law
44.261	Juvenile Delinquency
44.321	Criminology II
44.331	Penal Law
44.335	Juvenile Court Philosophy and Practice
44.354	Probation and Parole
44.360	Minorities and the Criminal Justice System
44.370	Criminal Justice Management
44.371	Criminal Justice Planning and Evaluation
44.380	Selected Issues in Law and Justice
+44.390	Introduction to Criminal Justice Research
+44.490	Criminal Justice Research Seminar
+44.496	Practicum (In-service students will substitute 44.370 or 44.371)

## Corrections

*+44.101	The Criminal Justice System
46.230	Law and the Legal System
44.151	Introduction to Corrections
*+44.221	Criminology I
*+44.234	Criminal Law
*44.261	Juvenile Delinquency
44.331	Penal Law
44.351	Alternatives to Corrections
44.354	Probation and Parole
44.370	Criminal Justice Management
44.371	Criminal Justice Planning and Evaluation
44.372	Issues in Correctional Administration
+44.390	Introduction to Criminal Justice Research
+44.490	Criminal Justice Research Seminar
+44.496	Practicum (In-service students will substitute 44.370 or 44.371)

\* Associate Degree Courses

+ Bachelor Degree Courses

**Note:** The major in the Bachelor of Science in Public Service: Administration of Criminal Justice consists of at least 36 credits in criminal justice courses, of which at least 15 credits should be at the 300 course level or above.

## C. Additional Requirements

1. Collateral Requirements 18 credits  
(6 courses selected from the following list)
  - 42.382 Crime in Literature
  - 43.308 History of Crime, Conflict and Social Control in the U.S.
  - 45.203 Introduction to Ethics
  - 46.105 Introduction to Public Policy
  - 46.230 Law and the Legal System
  - 46.345 Constitutional Law and Politics
  - 46.347 Civil Liberties, Law and Politics
  - 46.356 Public Policy Analysis
  - 47.163 Human Life Span
  - 47.209 Social Psychology
  - 47.232 Psychology of Personality
  - 47.272 Abnormal Psychology
  - 47.364 Psychology of Crime and Corrections
  - 48.231 Sociology of the Family
  - 48.255 Social Deviance
  - 48.361 Sociology of Law and the Criminal Justice System
  - 92.183 Introduction to Statistics
  - 92.265 Pascal Programming
  - 92.363 SPSS-X (Intro. to Data Analysis)
2. Free Electives Remaining credits  
(Selected with permission of Program Coordinator)  
Please note that from among all electives, either collateral or free electives that the student presents for graduation, at least 2 must be at the 300 or 400 course level.
3. Professional Skills 12 credits  
Professional skills requirements can be satisfied in either one of the following areas:
  - a. Foreign Language (Intermediate level proficiency required)  
Spanish suggested.
  - b. Computer Programming and Statistics, proficiency to be demonstrated by passing a minimum of four courses (12 credits) from the approved list:
    - 44.201 Computer Applications in Criminal Justice or equivalent **plus** one of the following:
    - 92.263 FORTRAN Programming
    - 92.265 Pascal Programming
    - 92.365 COBOL Programming IThe student completes this requirement by taking the following:
    - 92.183 Introduction to Statistics and either
    - 92.363 SPSS-X (Intro. to Data Analysis) or
    - 92.335 Quantitative Methods or
    - 48.402 Social Research

## Social Sciences and History

Bachelor of Liberal Arts Degree: 120 Credits

- |   |                    |
|---|--------------------|
| I. General University Requirements:                                     | 33 - 35 credits    |
| A. College Writing I and II   | 6 credits          |
| B. University Core Requirements   | 27 - 29 credits    |
| II. Social Sciences and History Major (minimum 36 - maximum 60 credits) |                    |
| A. Area of Concentration  | minimum 18 credits |
| B. Second Area of Social Sciences or History                            | minimum 6 credits  |
| C. Third Area of Social Sciences or History                             | minimum 6 credits  |
| III. Option Minor   | 18 - 24 credits    |
| IV. Elective Courses  | remaining credits  |

Presently, students may select a concentration from History, Political Science, Psychology and Sociology. Students must earn a 2.20 cumulative grade point average in their area of concentration by the end of their senior year and must select at least 15 credit hours in 300-level courses or higher. Students selecting Psychology or Sociology as their area of concentration must take a 400-level seminar which has as its prerequisites the 6 courses (18 credits) previously taken in concentration. Students may select a minor (18-24 credits) in humanities, economics, computer mathematics option, mathematics. Mathematics minor must contain no courses less than Calculus I with 6 credits in 300-level courses or higher.

Electives may be chosen from economics, chemistry, science, mathematics, computer mathematics, clinical laboratory sciences, behavioral and social sciences, fine arts and humanities. In addition, minor courses may also include accounting (67.101, 67.102, 67.203, 67.204) and management (69.201, 69.221, 69.232, 69.253, 69.262).

# Certificate in Computer Proficiency

In our industrial world of high technology, a person must be comfortable working with computers, and be able to understand how computers can be used for improved efficiency in the marketplace. People with the ability to utilize computers to improve the workplace will be in great demand in American industry, and will be guaranteed a satisfying and rewarding career.

## Program Description

The University of Lowell offers any person, who so desires, the opportunity to pursue the knowledge of computers that will make them a highly desirable employee in the workforce of the 1990's.

To obtain the **Certificate in Computer Proficiency**, a person must take five computer courses. Two courses, 92.202 Microcomputers and Applications Software and 92.265 Pascal Programming, are required for all students in this program. Three elective courses selected from the current list of computer course offerings\* by Continuing Education, are also required (\* 92.209 Introduction to BASIC does not count as a course towards the certificate). All courses must be passed with a grade of C or better.

## Application to the Program

Admission to this program is open to all. There are, however, prerequisite areas which enrollees must be proficient in. Students should have a high school knowledge of algebra and some fundamental experience with computers. Students who lack either or both of these two prerequisites will be able to remedy these deficiencies by taking 90.111 Fundamentals of Algebra and/or 92.209 Introduction to BASIC.

An application form for this program should be filed in the Office of Continuing Education. Professor Shapiro or Professor Doerr will be available for counselling Monday through Thursday after 5:00 p.m. Students should call (508) 934-2480 to arrange an appointment with a counselor.

## Required Courses

- 92.202 Microcomputers and Applications Software
- 92.265 Pascal Programming

## Elective Courses (3 courses)

- |  |  |
|--|--|
| 92.219 BASIC Programming                     | 92.368 COBOL Programming II                      |
| 92.263 FORTRAN Programming                   | 92.455 Assembly Language Programming I           |
| 92.267 C Programming                         | 92.461 System Simulation and Modeling            |
| 92.321 Discrete Structures I                 | 92.468 Microcomputer Principles and Applications |
| 92.360 Introduction to Data Structures       | 92.470 Data Communications                       |
| 92.363 SPSSX - Introduction to Data Analysis | 92.474 Data Base Concepts                        |
| 92.364 Problem Solving with Pascal           |  |
| 92.365 COBOL Programming                     |  |
| 92.366 Problem Solving with FORTRAN          |  |



# **Certificate in Industrial Security Management**

This program is intended to provide useful knowledge and pertinent information while preparing those working in - or preparing to work in - corporate/industrial security. The program will also be of interest to managers concerned with loss prevention/control, especially in the areas of physical, personnel and information security.

## **Program Description**

In order to obtain a **Certificate in Industrial Security Management**, students must take six required courses and three elective courses directed to their specific interests. Students may transfer up to six credits of course work taken either from the University of Lowell or from some other accredited institution. Students who have successfully completed the program may later apply appropriate courses and credits to an associate's or bachelor's degree program.

## **Application to the Program**

Applications into this program are available in the Office of Continuing Education. Admission to this program is open to all. A coordinator is available in the Office of Continuing Education for advice on course selection and career counselling. For an appointment or an application, call (508) 934-2480.

## **Required courses**

- 44.111 Introduction to Industrial Security
- 44.201 Computer Applications in Criminal Justice
- 44.211 Physical Security
- 44.234 Criminal Law
- 44.241 Principles of Investigation
- 44.312 Security Management

## **Elective courses (3 courses)**

- 19.401 Occupational Health
- 20.310 Industrial Safety
- 44.385 Crime and Mental Illness
- 44.101 The Criminal Justice System
- 47.272 Abnormal Psychology
- 47.356 Organizational Psychology
- 67.101 Accounting Principles I
- 67.102 Accounting Principles II
- 69.251 Personnel Management
- 84.111 General Chemistry
- 90.457 Computer Security

# Certificate in Technical Communication

Technical Writing is a form of expository writing that fashions practical, work-related documents. These documents often take the form of user guides and reference manuals that explain how to use products. For example, you might write a guide to setting up a computer system or write a manual about a word processor. Technical writers work one-on-one with product developers and marketing professionals in a very active and satisfying environment.

## Program Description

The University of Lowell Technical Communication program allows you to complete your certificate part-time in the evenings within 16 months while you continue working at your current job. Through individualized assignments, guest lectures, on-site visits and your own research, you acquire firsthand knowledge of the computer and technical writing fields.

Students take courses divided into two tracks that comprise the essential skills of the field. Certificate candidates are required to maintain a 2.5 "BC" overall average in the program. Candidates who have passed the required computer courses with a "BC" or better may transfer these credits into the program. All four writing courses should be taken in the prescribed sequence.

## Application to the Program

Anyone wishing admission to the program must: have a bachelor's degree from an accredited college; complete a college-level computer programming class with a "BC" or better (this requirement may be met while enrolled in 42.401 Principles of Technical Writing); and complete the course, Principles of Technical Writing with a "BC" or better.

## Internships

Paid and unpaid internships with small and large computer companies are available to participants who have completed the first two writing workshops.

## Required courses

### Technical Writing Track

42.401 Principles of Technical Writing  
42.402 Software Writing  
42.403 Advanced Software Writing  
42.404 Marketing Writing

### Computer Science Track

90.220 Introduction to Basic  
Computer Architecture  
92.265 Pascal Programming \*  
92.364 Problem Solving with Pascal \*  
92.474 Data Base Concepts

\* Students may petition to substitute one year of Cobol, Fortran, or C programming language for the preferred Pascal. Please see our catalog for complete course descriptions and prerequisites.

# The James B. Francis College of Engineering

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Aldo Crugnola, Dean; A.B., M.S., Sc.D.

Louis Petrovic, Assistant Dean, B.S., M.S., M.B.A., Ph.D.

Mukti L. Das, Civil Engineering Technology Coordinator, B. Eng., M.S., Ph.D.

J. Robert Lemieux, Electronic Engineering Technology Coordinator, B.S., M.S.

Majid Charmchi, Mechanical Engineering Technology Coordinator,  
B.S., M.S., Ph.D.

Richard C. Minesinger, Industrial Technology Coordinator, B.S.E., M.B.A.

The College of Engineering offers the following Continuing Education undergraduate programs:

Associate of Science:

- Civil Engineering Technology
- Electronic Engineering Technology
- Mechanical Engineering Technology

Bachelor of Science:

- Civil Engineering Technology
- Electronic Engineering Technology
- Mechanical Engineering Technology

Bachelor of Science in Industrial Technology:

- Manufacturing Option
- Plastics Option
- Water and Wastewater Option

## Engineering Technology Mission Statement

Engineering Technology is that part of the technology field that requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities; it lies in the occupation spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer. Engineering Technology programs are primarily concerned with producing graduates to work with and manage machines, materials, processes, people and money for industrial firms. Thus, engineering technicians or technologists work in such areas as product sales and distribution, operation service and maintenance, manufacturing and production, and routine design.

# Civil Engineering Technology

Associate of Science and Bachelor of Science Programs

Years 1 - 4 Leading to the Degree of

Associate of Science in Civil Engineering Technology: 68 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.121	Precalculus Mathematics	3	92.115	College Trigonometry	3
23.101	Engineering Graphics I	2	15.113	CAD	2
92.263	FORTTRAN Programming	3	42.101	College Writing I	3
		8			8

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
15.123	Surveying I	4	15.124	Surveying II	4
92.125	Calculus A	3	92.126	Calculus B	3
99.131	Technical Physics I	3	15.237	Statics	3
		10			10

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
99.132	Technical Physics II	3	15.239	Strength of Materials	3
15.246	Introduction to Hydraulics	3	15.247	Hydraulics Laboratory	1
42.102	College Writing II	3	42.226	Technical and Scientific Communication	3
		9			7

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
15.254	Soil Mechanics I	3	15.257	Highway Elements	3
15.251	Structural Analysis I	3	15.242	Steel Design I	3
15.253	Reinforced Concrete I	3	15.224	Material/Structural Laboratory	1
		9			7



Years 5 - 8 Leading to the Degree of

Bachelor of Science in Civil Engineering Technology: 134 Credits

Suggested Course of Study

First Semester (September)

Second Semester (January)

**Fifth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
84.111	General Chemistry I	3	15.392	Soil Mechanics II	3
84.113	General Chemistry Laboratory	1	15.383	Steel Design II	3
-----	Area II Elective	<u>3</u>	15.394	Soil Mechanics Laboratory	<u>1</u>
		7			7

**Sixth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
15.356	Environmental Technology	3	15.391	Reinforced Concrete II	3
99.133	Technical Physics III	3	15.238	Dynamics	3
92.225	Calculus C	<u>3</u>	15.256	Water and Wastewater Laboratory	<u>1</u>
		9			7

**Seventh Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
68.201	Economics I (Microeconomics)	3	15.352	Structural Analysis II	3
17.380	Electrical Basics and Laboratory	3	68.202	Economics II (Macroeconomics)	3
92.386	Statistics for Science and Engineering	<u>3</u>	-----	Area II Elective	<u>3</u>
		9			9

**Eighth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
15.463	Construction Technology	3	-----	Technical Elective	3
20.414	Industrial Economic Management	3	15.486	Transportation Elements	3
-----	Human Values Elective	<u>3</u>	-----	Area I or II Elective	<u>3</u>
		9			9

# Electronic Engineering Technology

Associate of Science and Bachelor of Science Programs

Years 1 - 4 Leading to the Degree of

Associate of Science in Electronic Engineering Technology: 65 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
42.101	College Writing I	3	42.102	College Writing II	3
92.121	Precalculus Mathematics	3	92.115	College Trigonometry	3
-----	Area I or II Elective	<u>3</u>	92.219	BASIC Programming	<u>3</u>
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
17.213	Electric Circuits	3	17.214	Circuits and Laboratory I	2
92.125	Calculus A	3	92.126	Calculus B	3
42.226	Technical and Scientific Communication	<u>3</u>	99.131	Technical Physics I	<u>3</u>
		9			8

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
17.215	Circuits and Laboratory II	2	17.216	Advanced Circuits	3
17.355	Electronics and Laboratory I	2	17.356	Electronics and Laboratory II	2
99.132	Technical Physics II	<u>3</u>	99.133	Technical Physics III	<u>3</u>
		7			8

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
17.350	Control Systems I	3	17.353	Digital Electronics	3
17.357	Electronics and Laboratory III	2	17.358	Electronics and Laboratory IV	2
17.371	Logic Design I	<u>3</u>	17.380	Microprocessor Basics	<u>2</u>
		8			7

Students enrolling in this program should purchase an electronic calculator capable of handling logarithmic and trigonometric functions. The use of the calculator will be an integral part of courses 17.213 and 17.214, where proficiency will be developed. Competency in the use of the calculator will be assumed in all subsequent E.E.T. courses.

Proper approval for a 17.4-- course is automatically assumed if all prerequisites are

satisfied. Proper approval for Area I, Area II or Human Values courses is automatically assumed if all prerequisites are satisfied and the course is selected from those listed in this catalog. Any changes to the list of approved courses will be posted in the Office of Continuing Education. Proper approval for course substitution or other deviation from the above can be obtained only by written permission.

Years 5 - 8 Leading to the Degree of  
 Bachelor of Science in Electronic Engineering Technology: 132 Credits

Suggested Course of Study

First Semester (September)			Second Semester (January)		
Fifth Year					
<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
17.367	Digital Devices and Laboratory	2	17.368	Data Conversion and Laboratory	2
17.372	Logic Design II	3	17.317	Minicomputer Programming	3
92.225	Calculus C	<u>3</u>	92.226	Calculus D	<u>3</u>
		8			8
Sixth Year					
<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
17.365	Applied Linear Devices	3	17.361	Project Laboratory A	2
92.234	Differential Equations	3	17.230	Mathematics & Statistics/ E.E.T.	3
92.265	Pascal Programming OR	<u>3</u>	17.382	Problems in E.E.T.	<u>3</u>
92.267	C Programming				
		9			8
Seventh Year					
<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
17.4--	E.E.T. Elective	3	17.4--	E.E.T. Elective	3
17.376	Electromagnetic Theory I	3	17.4--	E.E.T. Elective	3
-----	Area II Elective	<u>3</u>	-----	Area II/Human Values Elective *	<u>3</u>
		9			9
Eighth Year					
<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
68.201	Economics I (Microeconomics)	3	68.202	Economics II (Macroeconomics)	3
17.391	Project Laboratory B	2	17.392	Project Laboratory C	2
17.4--	E.E.T. Elective	<u>3</u>	17.4--	E.E.T. Elective	<u>3</u>
		8			8

\* Must appear on **both** the Human Values and Area II Elective list

# Mechanical Engineering Technology

Associate of Science and Bachelor of Science Programs

Years 1 - 4 Leading to the Degree of

Associate of Science in Mechanical Engineering Technology: 66 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.121	Precalculus Mathematics	3	92.115	College Trigonometry	3
23.101	Engineering Graphics I	2	23.102	Engineering Graphics II	2
42.101	College Writing I	<u>3</u>	42.102	College Writing II	<u>3</u>
		8			8

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
92.125	Calculus A	3	92.126	Calculus B	3
99.131	Technical Physics I	3	99.132	Technical Physics II	3
42.226	Technical and Scientific Communication	<u>3</u>	92.263	FORTRAN Programming	<u>3</u>
		9			9

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
23.200	CADrf	3	17.130	Electrical Basics and Laboratory	2
23.221	Statics	3	23.222	Dynamics	3
23.241	Elements of Thermodynamics I	<u>3</u>	23.223	Mechanics of Materials I	<u>3</u>
		9			8

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
23.242	Applied Fluid Mechanics	3	17.131	Electronic Basics and Laboratory	2
23.320	Machine Design	3	-----	Area II Elective	3
23.202	Thermo/Fluids Laboratory	<u>2</u>	23.302	Mechanics Materials Laboratory	<u>2</u>
		8			7



Years 5 - 8 Leading to the Degree of

Bachelor of Science in Mechanical Engineering Technology: 136 Credits

Suggested Course of Study

First Semester (September)

Second Semester (January)

**Fifth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
99.133	Technical Physics III	3	17.132	Digital Basics and Laboratory	2
92.225	Calculus C	3	92.226	Calculus D	3
84.121	Chemistry I	<u>3</u>	23.354	Problems in M.E.T.	<u>3</u>
		9			8

**Sixth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
23.295	Materials Science	3	47.101	General Psychology	3
-----	Free Elective	3	23.243	Elements of Thermodynamics II	3
-----	Area II Elective	<u>3</u>	-----	Human Values Elective	<u>3</u>
		9			9

**Seventh Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
68.201	Economics I (Microeconomics)	3	68.202	Economics II (Macroeconomics)	3
23.475	Heat Transfer	3	23.480	CADes	3
23.402	Eng. Measurements Lab	<u>2</u>	23.4--	M.E.T. Elective	<u>3</u>
		8			9

**Eighth Year**

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.414	Industrial Economic Management	3	23.405	Senior Project	3
20.305	Manufacturing Processes	3	-----	Technical Elective	3
-----	Technical Elective	<u>3</u>	23.4--	M.E.T. Elective	<u>3</u>
		9			9

Proper approval for a 23.4-- course is automatically assumed if all prerequisites are satisfied. Proper approval for Area I, Area II or Human Values courses is automatically assumed if all prerequisites are satisfied and the course is selected from those listed in this catalog. Any changes to the list of approved courses will be posted in the Office of Continuing Education. Proper approval for course substitution or other deviation from the above can be obtained by written permission.

# Industrial Technology: Manufacturing Option

Bachelor of Science in Industrial Technology: Manufacturing Option: 133 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
42.101	College Writing I	3	42.102	College Writing II	3
67.101	Accounting Principles I	3	47.101	General Psychology	3
92.121	Precalculus Mathematics	<u>3</u>	92.115	College Trigonometry	<u>3</u>
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.105	Introduction to Design	3	20.209	CAD	2
48.101	Introduction to Sociology	3	42.226	Technical and Scientific Communication	3
92.125	Calculus A	<u>3</u>	92.126	Calculus B	<u>3</u>
		9			8

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
23.221	Statics	3	23.223	Mechanics of Materials I	3
84.111	General Chemistry I	3	68.201	Economics I (Microeconomics)	3
84.113	General Chemistry Lab I	<u>1</u>	92.263	Fortran Programming	<u>3</u>
		7			9

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.201	Introduction to Materials	3	92.386	Statistics for Science and Engineering	3
20.211	Materials Laboratory	1	-----	Area I or II Elective	3
99.131	Technical Physics I	<u>3</u>	99.132	Technical Physics II	<u>3</u>
		7			9

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### Fifth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
17.130	Electrical Basics and Laboratory	2	17.131	Electronic Basics and Laboratory	2
20.112	Machine Tool Processes	3	20.305	Manufacturing Processes	3
42.222	Oral Communication	<u>3</u>	20.310	Industrial Safety	<u>3</u>
		8			8

### Sixth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
17.132	Digital Basics and Laboratory	2	20.309	Process Measurement and Controls	2
20.314	Motion and Time Study	3	20.303	Mechanical Systems	3
-----	Area II Elective	<u>3</u>	69.221	Marketing Principles	<u>3</u>
		8			8

### Seventh Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.307	Fluid Power Control	3	20.406	Thermodynamics	3
20.408	Microprocessors	2	20.416	Statistical Quality Control	3
69.253	Organizational Behavior	<u>3</u>	69.271	Operations Management	<u>3</u>
		8			9

### Eighth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.414	Industrial Economic Management	3	20.405	Senior Project	3
20.427	Plant Layout and Materials Handling	3	20.419	Computer-Aided Manufacture	2
-----	Area II Elective	<u>3</u>	-----	Human Values Elective	<u>3</u>
		9			8

Electives must be approved by the Program Coordinator.

## Industrial Technology: Plastics Option

Bachelor of Science in Industrial Technology: Plastics Option: 139 to 141 credits

(\*) Indicates Required Courses

### University Requirements: 33 credits

42.101	College Writing I	3
42.102	College Writing II	3
47.101	General Psychology	3
48.101	Introduction to Sociology	3
68.201	Economics I (Microeconomics)	3
42.226	Technical & Scientific Communication	3
-----	Area I Elective	3
-----	Area I Elective	3
-----	Area II Elective	3
-----	Area II Elective	3
-----	Human Values Elective	3

### Mathematics and Science Requirements: 36 credits

92.121	Precalculus Mathematics *	3
92.115	College Trigonometry *	3
92.125	Calculus A *	3
92.126	Calculus B *	3
92.225	Calculus C	3
92.226	Calculus D	3
92.234	Differential Equations	3
92.386	Statistics for Science and Engineering	3
99.131	Technical Physics I *	3
99.132	Technical Physics II *	3
20.202	Industrial Computer Science	3
92.263	Fortran Programming	3
92.265	Pascal Programming	3
92.267	C Language Programming	3
84.121	Chemistry I *	3
84.122	Chemistry II *	3
84.223	Principles of Organic Chemistry I *	3
84.224	Principles of Organic Chemistry II *	3

### Engineering Technology Requirements: 10 - 12 credits

17.130	Electrical Basics and Lab *	2
23.111	Engineering Drawing I *	2
23.221	Statics *	3
23.222	Dynamics	3
20.307	Fluid Power Control	3
20.309	Process Measurement & Control	3



**Engineering Technology Requirements (Con't):**

20.310	Industrial Safety	3
20.402	Manufacturing Operations	3

**Management Requirements:****15 credits**

69.221	Marketing Principles *	3
69.251	Personnel Management *	3
69.262	Business Law I *	3
-----	Management or Accounting Elective	3
-----	Management or Accounting Elective	3

**Plastics Requirements:****36 credits**

27.201	Plastics Material Science I *	3
27.202	Plastics Material Science II *	3
27.303	Plastics Material Science III *	3
27.401	Processing Technology I *	3
27.402	Processing Technology II *	3
27.301	Additives for Polymeric Materials	3
27.303	Reinforced Plastics/Composites	3
27.373	Plastics Mold Engineering I	3
27.376	Plastics Mold Engineering II	3
27.403	Physical Properties of Polymers I	3
27.404	Physical Properties of Polymers II	3
27.406	Polymer Structures	3
27.407	Plastics Industry Organization	3
27.425	Rheology I	3
27.426	Rheology II	3
27.440	Commercial Development	3
27.451	Selected Topics in Polymers I	3
27.452	Selected Topics in Polymers II	3
27.453	Colloids	3
27.454	Selected Topics in Polymers IV	3
27.455	Selected Topics V	3
27.456	Selected Topics VI	3
27.457	Plastics Coatings in Electronics	3
27.458	Selected Topics VIII	3

**Free Elective Requirements:****9 credits**

-----	Free Elective	3
-----	Free Elective	3
-----	Free Elective	3

# Industrial Technology: Water and Wastewater Option

Bachelor of Science in Industrial Technology:

Water and Wastewater Option: 130 credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
First Semester (September)			Second Semester (January)		
42.101	College Writing I	3	42.102	College Writing II	3
92.121	Precalculus Mathematics	3	92.115	College Trigonometry	3
67.101	Accounting Principles I	<u>3</u>	47.101	General Psychology	<u>3</u>
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.105	Introduction to Design	3	-----	Area II Elective	3
48.101	Introduction to Sociology	3	92.126	Calculus B	3
92.125	Calculus A	<u>3</u>	99.131	Technical Physics I	<u>3</u>
		9			9

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
23.221	Statics	3	68.201	Economics I (Microeconomics)	3
84.111	General Chemistry I	3	42.226	Technical & Scientific Communication	3
84.113	General Chemistry Lab I	<u>1</u>	92.386	Statistics for Science and Engineering	<u>3</u>
		7			9

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.251	Wastewater Treatment Plant Operations I	3	20.252	Wastewater Treatment Plant Operations II	3
20.253	Wastewater Treatment Lab I	1	20.254	Wastewater Treatment Lab II	1
20.225	Water Chemistry I	<u>3</u>	20.226	Water Chemistry II	<u>3</u>
		7			7

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### Fifth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.255	Water Distribution Systems	3	20.152	Water Biology	3
17.130	Electrical Basics and Lab	2	17.131	Electronic Basics and Lab	2
20.202	Industrial Computer Science	<u>3</u>	-----	Area II Elective	<u>3</u>
		8			8

### Sixth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.351	Water Supply & Treatment Operations I	3	20.352	Water Supply & Treatment Operations II	3
20.353	Water Works Operations Lab I	1	20.355	Water Works Operations Lab II	1
-----	Area I or II Elective	<u>3</u>	69.271	Operations Management	<u>3</u>
		7			7

### Seventh Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.354	Industrial Waste Treatment	3	20.356	Hazardous Waste Mgt.	3
20.201	Introduction to Materials	3	20.257	Water/Wastewater Plant Management	3
20.211	Materials Laboratory	<u>1</u>	-----	Technical Elective	<u>3</u>
		7			9

First Semester (September)

Second Semester (January)

### Eighth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
20.310	Industrial Safety	3	20.416	Statistical Quality Control	3
20.414	Industrial Economic Mgt.	3	-----	Human Values Elective	3
-----	Technical Elective	<u>3</u>	20.452	Operation and Maintenance of Wastewater Collection Systems	<u>3</u>
		9			9

All Technical Electives must be approved by the Program Coordinator.

## College of Management Science

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Harvey Kahalas, Dean: B.S.B.A., M.B.A., Ph.D.

The Associate of Science degrees in Accounting, Banking and Management are offered under the jurisdiction of the College of Management Science. These associate degrees are considered terminal degrees and are not transferable into a Bachelor of Science in the College of Management Science at the University of Lowell.

Students who wish to continue their studies at the University in the College of Management Science must understand that most management courses **will not transfer** into the day program; however, most liberal arts and core requirement courses that have the same number as the day catalog are transferable into a University day program. Many of the courses in these Associate degree programs are transferable into other degree programs, such as Information Systems, in the Division of Continuing Education. For more specific information about the programs offered through the College of Management Science, students should see an advisor in the Division of Continuing Education.



# Accounting

Associate of Science Degree: 63 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
67.101	Accounting Principles I	3	67.102	Accounting Principles II	3
68.201	Economics I (Microeconomics)	3	68.202	Economics II (Macroeconomics)	3
42.101	College Writing I	<u>3</u>	42.102	College Writing II	<u>3</u>
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
90.112	Concepts in Algebra I	3	90.119	Concepts in Algebra II	3
67.203	Intermediate Accounting I	3	67.204	Intermediate Accounting II	3
42.224	Business Writing	<u>3</u>	67.262	Business Law I	<u>3</u>
		9			9

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
47.101	General Psychology	3	69.231	Business Finance	3
67.206	Cost Accounting I	3	-----	Area II Elective	3
92.202	Microcomputers and Application Software	<u>3</u>	69.241	Statistics for Business	<u>3</u>
		9			9

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>
69.232	Money and Banking	3
67.---	Accounting Elective	3
69.271	Operations Management	<u>3</u>
		9

This course outline which lists 3 courses each semester is only a suggested course load. First year students should not take more than 1 or 2 courses their first semester. Subsequent course loads may be determined by the students' own personal time constraints.

# Banking

Associate of Science Degree: 63 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
42.101	College Writing I	3	42.102	College Writing II	3
67.101	Accounting Principles I	3	67.102	Accounting Principles II	3
69.101	Principles of Banking	<u>3</u>	69.117	Law and Banking: Principles OR	<u>3</u>
			69.262	Business Law I	
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
68.201	Economics I (Microeconomics)	3	68.202	Economics II (Macroeconomics)	3
90.112	Concepts in Algebra I	3	90.119	Concepts in Algebra II	3
42.224	Business Writing	<u>3</u>	69.105	Consumer Lending	<u>3</u>
		9			9

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
69.119	Commercial Lending	3	69.231	Business Finance	3
47.101	General Psychology	3	-----	Area II Elective	3
92.202	Microcomputers and Application Software	<u>3</u>	69.241	Statistics for Business	<u>3</u>
		9			9

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>
69.---	Banking Elective	3
69.232	Money and Banking	3
69.271	Operations Management	<u>3</u>
		9

This course outline which lists 3 courses each semester is only a suggested course load. First year students should not take more than 1 or 2 courses their first semester. Subsequent course loads may be determined by the students' own personal time constraints.

# Management

Associate of Science Degree: 63 Credits

## Suggested Course of Study

First Semester (September)

Second Semester (January)

### First Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
67.101	Accounting Principles I	3	67.102	Accounting Principles II	3
68.201	Economics I (Microeconomics)	3	68.202	Economics II (Macroeconomics)	3
42.101	College Writing I	<u>3</u>	42.102	College Writing II	<u>3</u>
		9			9

### Second Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
69.201	Principles of Management	3	69.231	Business Finance	3
42.224	Business Writing	3	90.119	Concepts in Algebra II	3
90.112	Concepts in Algebra I	<u>3</u>	-----	.Business Elective	<u>3</u>
		9			9

### Third Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>	<u>No.</u>	<u>Title</u>	<u>Credits</u>
69.241	Statistics for Business	3	69.271	Operations Management	3
69.221	Marketing Principles	3	47.101	General Psychology	3
92.202	Microcomputers and Applications Software	<u>3</u>	69.262	Business Law I	<u>3</u>
		9			9

### Fourth Year

<u>No.</u>	<u>Title</u>	<u>Credits</u>
69.232	Money and Banking	3
-----	Area II Elective	3
69.251	Personnel Management	3
		9

This course outline which lists 3 courses each semester is only a suggested course load. First year students should not take more than 1 or 2 courses their first semester. Subsequent course loads may be determined by the students' own personal time constraints.







# Admissions

## **Admissions Procedures into Degree Programs**

All students are welcome to register for credit or non-credit courses in the Division of Continuing Education. There are no admissions requirements for anyone not entering a degree program. Students who decide to pursue an associate's degree or a bachelor's degree must apply for admission to the program through the Office of Continuing Education.

To be considered for acceptance into a degree program, students must hold a high school diploma or a Graduate Equivalency Diploma (GED). Continuing Education operates on a rolling admission basis and each application is reviewed when the student's file is complete. Students must be admitted to a degree program in order to be eligible for most financial aid.

The following materials must be submitted for admission:

1. an application (available in the Office of Continuing Education)
2. official transcripts of all college, university, or post-secondary schools attended, and
3. official transcript of high school records, or its equivalent (GED certificate) from applicants with no previous college/university experience

After the above information is filed in the Office of Continuing Education, an area coordinator will evaluate the academic records. Students will receive an official letter of acceptance and a transfer credit evaluation from the Associate Director of Continuing Education, normally within four weeks of submitting academic materials.

An academic counselor is available in the Office of Continuing Education to answer any questions regarding the matriculation process. Appointments may be made by calling (508) 934-2480.

## **Transfer Credit**

Students may transfer academic credit completed at other accredited institutions of higher education toward an associate's degree or bachelor's degree. Official transcripts must be sent to the Office of Continuing Education with the application.

Credit will be accepted if it is equivalent to University of Lowell instruction, if it is applicable to the intended program, and if the student has received a grade equivalent to a C or higher. Grades of transferred courses will be recorded with the notation CR which designates that credit has been granted and will not be computed into a student's cumulative grade point average at the University of Lowell.

Residency requirements (see Residency Requirements section) in this catalog are also considered when transfer credit is being evaluated. The University of Lowell subscribes to the Massachusetts Transfer Compact and maintains flexibility in the transfer of qualified students of the Commonwealth of Massachusetts.

### **Declaration of a Major**

Upon application, students are requested to declare a major. If students are uncertain about the major they wish to pursue, an "undeclared" listing may be used. Academic counselors are available to help students in selecting a field of concentration.

### **Non Matriculation**

Students who wish to register for classes but not be admitted into a degree program may do so provided they have the necessary prerequisites for the course. Credit will be awarded for the successful completion of such courses. If the student chooses to become a degree candidate, the applicability of such course(s) may be subject to other policies of the University and/or to specific program requirements. Enrollment in courses does not constitute admission to a degree program. In order to matriculate, students must complete the admission process as described above.



# Academic Policies and Procedures

## General Requirements for Baccalaureate Studies

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University policy requires all degree candidates to comply with the following standards:

1. mastery of at least one discipline, field of knowledge or applied professional area;
2. competence in writing the English language;
3. an understanding of the humanities, social sciences, mathematics, and science; and
4. a familiarity with problems and issues of value and choice.

All baccalaureate candidates are required to earn a 2.00 (C) cumulative average in their total course of study, to complete a minimum of 120 semester hours of course credits, to fulfill the residency requirements, to conform to the general regulations and requirements of the University, to satisfy the regulations and academic standards of the colleges which exercise jurisdiction over the degrees for which they are matriculating, to satisfy the curriculum requirements established by the departments or programs in their major, and to complete the University core requirements.

## Residency Requirements

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### Residency Requirements for Baccalaureate Studies

In addition to satisfying specific course and achievement requirements, each baccalaureate candidate must complete at least 15 semester hours in regular course work within the major department of the University for each major which is presented for a degree with a 30 semester hour minimum completed at the University. This 30 semester credit minimum may include established course equivalency procedures and authorized day courses in the University.

Each candidate for a baccalaureate degree must also satisfy one of the following residency requirements:

1. Complete an associate's degree under the provisions of the Massachusetts Transfer Compact in a Massachusetts Community College, earning not more than 60 semester credits, and the remainder in courses at the Univer-

sity, earning not less than 60 semester credits.

2. Complete up to the first two years in an accredited associate institution earning not more than 60 semester credits (C grades or better), and the remainder in courses at the University, earning not less than 60 semester credits.
3. Complete the equivalent of the first three years of a baccalaureate program in an accredited four-year institution, earning not more than 90 semester credits (C grades or better) and the remaining courses at the University, earning not less than 30 semester credits.
4. Complete 90 or more semester credits at the University and complete the remainder of the prescribed course of study at another accredited institution, earning not more than 30 semester credits at that institution.

### **Residency Requirement for Major Fields**

Each baccalaureate degree candidate must complete at least 15 credits of course work in their major at the University of Lowell for each major which is presented for a degree.

### **Residency Requirements for Associate Studies**

In addition to meeting all the course requirements of an associate's degree, candidates must adhere to the following residency requirements:

1. Each student must complete at least nine (9) semester credits in regular coursework in his/her major department and must complete at least 24 semester credits through the Division of Continuing Education at the University of Lowell.
2. A student may pursue an additional associate's degree under the same regulations set forth for pursuing an additional baccalaureate degree (see above) except that the total number of credits to satisfy the residency requirement is 24.



### **Guidelines for Additional Bachelor's Degrees**

A student who has already earned a baccalaureate degree may be admitted to the University to pursue an additional baccalaureate degree in accordance with the following:

1. the nomenclature of the additional degree to be pursued must be distinctly different from the previously conferred degree (e.g. Bachelor of Arts, Bachelor of Science, etc.);
2. the major field of the previous degree must be clearly distinct from that of the additional degree;
3. the work for the additional degree must include the Continuing Education residency requirements;
4. the final 30 credits presented for the additional degree must be in addition to and independent of any previous baccalaureate;
5. a minimum of 15 credits must be taken at the University in the major field which is presented for the additional degree; and
6. a minimum of 30 semester hours must be completed at the University.

## **University Core Requirements**

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### **A. English Composition Requirement (6 semester credits)**

All students must pass a sequence of two courses totaling six semester hours in composition (42.101 College Writing I, 42.102 College Writing II).

### **B. Area Distribution Requirements (27-29 semester credits)**

All students must pass a minimum of nine courses (a total of 27 to 29 semester credits) in the area distribution requirements. A student whose academic major falls in a discipline listed under Area I, II, or III, or whose professional major is related to one of these disciplines, is exempted from the distribution requirements for courses in that area. However, students whose primary or secondary majors are in disciplines of the humanities and social sciences are required to complete area distribution requirements as specified and no exemption, in whole or in part, is permitted. In fulfilling the core requirements, a student is limited to a maximum of two courses in any one department. Additionally, a student is limited to two courses in literature. Pass/no-credit courses may not be counted toward the completion of the area distribution requirements.

1. A minimum of two courses (six semester credits) must be completed in each Area I and Area II, plus two additional courses (six semester credits) selected from either or both of these areas. Total to satisfy this requirement is six courses or 18 semester hours.

### **Area I Courses: Social and Behavioral Sciences**

**Please note** that effective fall semester 1989, history courses were moved from Area I (Social Sciences) to Area II (Humanities). History courses which were taken before January 1989 are counted as Area I. History courses taken during the spring semester 1989 may be counted as either Area I or Area II. History courses taken during the fall semester 1989 and thereafter are to be counted as Area II only.

- 46.101 Introduction to American Politics
- 46.121 Introduction to International Relations
- 46.282 Contemporary Political Theory
- 47.101 General Psychology
- 47.163 The Human Life Span
- 47.209 Social Psychology
- 47.232 Psychology of Personality
- 47.255 Community Psychology
- 47.262 Adolescent Psychology
- 47.272 Abnormal Psychology
- 47.328 Dynamics of Interpersonal Relations
- 47.335 Psychology of Women
- 47.364 Psychology of Crime and Corrections
- 48.101 Introduction to Sociology
- 48.231 Sociology of the Family
- 48.241 Sociology of Women
- 48.361 Sociology of Law and the Criminal Justice System
- 59.203 Technology and Human Values I
- 59.204 Technology and Human Values II
- 68.201 Economics I (Microeconomics)
- 68.202 Economics II (Macroeconomics)
- 68.207 Government, Business and Society

### **Area II Courses: Fine Arts and Humanities**

- 42.201 Great Books of Antiquity
- 42.202 Great Books of the Modern Period
- 42.210 Drama
- 42.211 Poetry
- 42.212 The Short Story
- 42.217 The Horror Story
- 42.218 Comedy
- 42.267 Introduction to Shakespeare
- 42.291 History of English Literature I

- 42.292 History of English Literature II
- 42.294 History of American Literature I
- 42.295 History of American Literature II
- 42.317 British Literature of the Twentieth Century
- 43.105 Western Civilization
- 43.106 The Modern World
- 43.111 United States History to 1877
- 43.112 United States History Since 1877
- 43.206 American Economic History
- 43.242 The Second World War
- 43.363 Recent U.S. History, 1940 to Present
- 45.201 Introduction to Philosophy
- 45.202 Introduction to Logic
- 45.203 Introduction to Ethics
- 50.211 Intermediate Conversational French I
- 50.212 Intermediate Conversational French II
- 51.211 Intermediate German I
- 51.212 Intermediate German II
- 54.211 Intermediate Conversational Spanish I
- 54.212 Intermediate Conversational Spanish II
- 57.251 Visual Design I Studio  
(not for students in the College of Engineering)
- 57.255 Drawing I Studio (not for students in College of Engineering)
- 58.101 Appreciation of the Visual Arts
- 58.203 Survey of Art I
- 58.204 Survey of Art II
- 71.100 Basic Music Theory

2. A student must also complete a minimum of three courses (nine to eleven semester credits) in Area III. One course must be in a laboratory science, a second course must be in mathematics, and a third course must be in science or mathematics. Students who wish to satisfy the core requirement for a laboratory science must register for the corequisite laboratory wherever applicable. If a student elects to take a science without the laboratory component, it will not satisfy that part of the University core requirement of one laboratory science course. The total required to satisfy this requirement is three courses or nine to eleven semester credits.

### **Area III Courses: Science**

- 83.101 Life Science I
- 83.102 Life Science II
- 83.103 Life Science Lab I
- 83.104 Life Science Lab II
- 87.103 Earth and Its Environment
- 89.101 General Geology I
- 89.102 General Geology II
- 89.103 General Geology Lab I
- 89.104 General Geology Lab II
- 93.141 Weather and Climate

### **Area III Courses: Mathematics**

- 92.121 Precalculus Mathematics
- 92.183 Introduction to Statistics
- 92.265 Pascal Programming

### **C. Human Values Requirements (3 semester credits)**

All students are required to pass one Human Values course listed below unless a department indicates that the human values requirement is satisfied by a designated department requirement.

### **Human Values Courses**

- 00.101 Values and Creative Thinking
- 45.201 Introduction to Philosophy
- 45.203 Introduction to Ethics
- 46.282 Contemporary Political Theory
- 47.209 Social Psychology
- 48.201 Social Anthropology
- 48.241 Sociology of Women
- 59.203 Technology and Human Values I
- 59.204 Technology and Human Values II
- 68.207 Government, Business and Society



# Grading Information

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## Grading System

The following qualitative letter grades are employed by the University to characterize the quality of a student's work in a course:

		Quality Points
A	work done by the student is superior and is of the highest honors quality;	4
AB	the work done by the student is less than superior but is completed with a level of distinction which is higher than the basic honors level;	3.5
B	basic honors quality;	3
BC	less than honors quality but is better than satisfactory;	2.5
C	satisfactory work which conforms to the general expectations of the University for baccalaureate study;	2
CD	less than satisfactory and below graduation standards but is better than the minimum requirement for passing a course;	1.5
D	minimum requirement for passing a course;	1
F	course failure	0

In addition to the above letter grades, the following symbols are also used to designate special enrollment provisions or course statuses and do not affect the student's academic average:

S	satisfactory completion of a practicum experience course with a grade of C or higher;
U	unsatisfactory performance in a practicum experience course with a final course grade of less than C;
I	not completed;
W	official withdrawal from a course within the established deadline;
X	withdrawal after the established deadline for administratively approved reasons for an emergency or medical nature;
Y	administrative dismissal for other than academic reasons;
AU	registration for a course on an audit basis

## Withdrawal

W notation is not an academic grade but a symbol designating official withdrawal from a course within the established deadline of the eighth week of class of a semester. Official withdrawal is accomplished by filing a withdrawal form in the Office of Continuing Education.

A notation of W cannot be given for unofficial withdrawal from a course or for unofficial withdrawal from the University. Accordingly, a student who registers for a course and is carried on an official class roster after the eighth week of a semester must be graded in terms of the completion of the instructor's total course requirements even though the student did not attend any class meeting or unofficially left

the University before the eighth week of the semester. A student who wishes to withdraw from a course after the deadline of the eighth week must submit a petition to the Office of Continuing Education. An X will be given only when it can be demonstrated that extended illness or a critical personal emergency of an extended nature prevented that student from complying with official withdrawal procedures. Students receiving benefits from the Veterans Administration are not eligible for retroactive withdrawal from courses.

### **Incomplete**

An Incomplete (I) is given at the discretion of the instructor. Students should not take it for granted that they will receive a grade of incomplete without first consulting with the instructor. However, responsibility for completing all outstanding work rests entirely with the student. The Incomplete notation carries with it a reserve letter grade; if all outstanding work is not acceptably made up and submitted within a four-week period following the final examination, the incomplete will automatically become whatever the instructor has designated as this reserve grade.

If the work is satisfactorily completed within the designated time, the instructor will replace the I notation (and its reserve grade) with an appropriate letter grade. Outstanding work may be made up after the four-week period, but arrangements for this make-up must be completed within the original four-week period and permission of the Associate Director of Continuing Education must be obtained for the extension of time.

### **Repeated Course Work**

Students must repeat and pass all required courses which they have failed. Any failed course which is a prerequisite for another must be repeated and passed before the student can take the advanced course.

Students may repeat a limited number of courses in which they received a grade of F and have the repeated grade substituted for the original grade in the computation of the cumulative grade-point average. Non-probationary students must repeat courses within 30 semester hours (equivalent to 2 semesters of full-time study) following their course failures. Although probationary students may not invoke the grade substitution provision during their periods of probation, they may invoke the grade-substitution process upon removal from probation. Students entering as freshmen or transferring with less than 60 semester credits are permitted a maximum of 10 credits of course repetition for grade substitution; students transferring with 60 or more semester credits are permitted a maximum of 7 credits of course repetition for grade substitution. Students must designate by petition which courses are being repeated for the purpose of grade substitution before re-enrolling.

Prior to an initial determination of academic progress, a student may not repeat courses for grade substitution. Students may repeat a passed course within the provisions of the grade substitution rule cited above; however, if the grade of the repeated course is less than the original grade, both grades will be used in computing the grade point average.

## Course Equivalency Examination

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Subject to specified policies of academic departments, qualified degree candidates are given the opportunity to demonstrate their special competencies and to receive University credit for such competencies through established course equivalency procedures without having to fulfill classroom or faculty course requirements. The University recognizes two types of course equivalency for which credit is awarded.

These are:

1. College Level Examination Program (CLEP), and
2. departmental examinations.

Students may not receive credit for a specific proficiency examination:

1. if they have registered at the University in the course which that examination represents,
2. if they have previously received a University grade for that course or a course in sequence above the course for which they wish to take the examination,
3. if they have previously attempted an equivalent course at another institution and,
4. if a general examination is related to the student's academic major.

Credit for general examinations of CLEP may not be granted to students after their admission to the University as matriculating students. Students may apply for course equivalency credits up to a maximum of 42 credits; however, the total number of equivalency and transfer credits may not exceed 90 credits for the baccalaureate degree. Nor may transfer students present equivalency credits in fulfillment of the major field residency requirement of 15 credits in University courses or the general residency requirement of 30 credits.

### **College Level Examination Program (CLEP)**

Course equivalency credits can be awarded through successful completion of the College Level Equivalency Program (CLEP) examinations. CLEP is a national program of credit-by-examination that offers the opportunity to obtain recognition for college level achievement, no matter when, where, or how learning has been acquired. These examinations can be taken in general subject areas or in specific subject areas. If the results of the examination(s) are acceptable to University guidelines, college credit is given toward an undergraduate degree.

General Examination of CLEP may be presented for credit if scores of 500 or better have been obtained. A student who achieves a score of 500 or above in the English Composition examination satisfies the requirement for College Writing I. Credit for the Natural Sciences examination may be granted only to students who matriculate for degrees in other than the colleges of Engineering, Health Professions, and Pure and Applied Science. Also, credit in the Natural Sciences examination does not satisfy the specific laboratory requirements of the University Core Requirements.

Continuing Education students who are interested in taking subject examinations of the College Level Examination Program should secure petition forms from the Office of Continuing Education which must be approved by their program coordinator prior to the administration of the exam. Application to take approved subject examination may be obtained in the Office of Continuing Education. CLEP tests are administered at the University during the third week of each month.

Please note that the College of Arts and Sciences does not recognize and will not award credit for CLEP tests in a foreign language offered to satisfy the language proficiency requirement.

### **Departmental Examinations**

Students interested in taking departmental examinations must first arrange an interview with the appropriate coordinator, at which time they must present evidence that they possess sufficient competency to warrant a departmental examination. Departmental examinations will not be given if a corresponding CLEP examination is available. Departments reserve the right to refuse the granting of credit by examination for those courses which are presented by students for their major. When written permission is given to a student to take a departmental examination, the conditions of the examination will be set forth. A \$37.50 fee must be paid before taking the examination.

## **Academic Standing**

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### **Grade Point Requirements**

Students are subject to the grade-point requirements shown on the next page for the specified numbers of completed course hours.

These grade-point averages are minimum University requirements. Individual colleges/departments may establish higher standards.



Course Hours Attempted*	Grade-Point Averages for Satisfactory Standing	Grade-Point Averages for Academic Warning	Grade-Point Averages for Academic Suspension
12-30	1.500	1.400-1.499	1.399 or below
31-45	1.600	1.500-1.599	1.499 or below
46-60	1.700	1.600-1.699	1.599 or below
61-75	1.800	1.700-1.799	1.699 or below
76-90	1.900	1.800-1.899	1.799 or below
91- Graduation	2.000	1.900-1.999	1.899 or below

\* Included in "Course Hours Attempted" are all course credits which have been granted (including credits awarded through transfer and challenge by examination, course credits which have been awarded with qualitative letter grades, and credits attempted with notations of incomplete or nonqualitative "P" and "S" grades) and all hours of course work which have been failed with the qualitative letter grade of "F".

Specified Grade-Point Averages are computed solely on the basis of those courses completed at the University of Lowell or through University auspices under previous policies which governed authorized off-campus study and which were qualitatively evaluated with the following letter grades: A, AB, B, BC, C, CD, D, and F.

At the end of each official grading period, the Office of Continuing Education automatically evaluates the cumulative averages of all matriculating students for compliance with University retention standards. Students whose cumulative grade-point averages are below retention requirements at the end of any official grading period have not made satisfactory academic progress and are so notified on their computerized grade report. Students whose cumulative grade-point averages fall below the requirements for their attempted course credits by more than 0.10 are immediately suspended. Students whose cumulative grade-point averages are not more than 0.10 below the requirements for their attempted course credits are placed on academic warning. Students who have been placed on academic warning must achieve satisfactory standing upon the completion of 15 additional hours of course work or they will be suspended from the University.

### **Academic Probation**

A student who has been suspended from the University as a matriculating student in Continuing Education is entitled to apply to the Office of Continuing Education for readmission as a probationary student in accordance with procedures enumerated under the admission policy heading Probationary Readmission. Students who are readmitted on probation will receive a letter from the appropriate Academic Standards Committee that specifies their probationary courses and the academic average they must achieve during their probation to achieve satisfactory academic standing.

A student who achieves the required academic average during his or her probation is automatically reinstated in satisfactory academic standing. A student whose average falls below the requirement by no more than 0.10 may be granted an extension of the probation, permitting completion of an additional 15 credits. Such extension would be made by the appropriate Academic Standards Committee during the period between semesters. Students who are granted such extensions will be notified in writing prior to the beginning of classes for the following semester. Students who fail to satisfy probationary standards and are not granted extensions, and students who are granted such extensions and fail to achieve satisfactory academic standing by the end of the designated period are permanently dismissed from the University and are subsequently barred from attending both day and evening courses.

Students who have been readmitted on probation may not invoke University regulations which govern course repetition for the purpose of deleting course grades from cumulative averages. Nor may they withdraw from any course unless they withdraw from the University with permission of the Associate Director of Continuing Education for reasons of an emergency or medical nature. A probationary student who withdraws from any course without authorization of the Associate Director of Continuing Education cannot by definition satisfy the conditions of his or her probation and will be permanently dismissed from the University at the end of the current semester of enrollment.

Probationary students who receive course evaluations of I (incomplete) and who fail to make up their work under the regulations of an I grade are advised that they may not qualify for extension of their probation, may not register for nor attend University courses (including summer courses), and may not receive authorization to pursue off-campus studies until a final determination of their status has been made. Accordingly, probationary students are advised that they should not delay completion of course work until the make-up deadline which has been established for students in satisfactory academic standing unless they wish to postpone resumption of their studies. Students who have received permission of the Associate Director of Continuing Education to extend their make-up period are advised that such authorized extension does not waive the requirement for a final determination of academic standing which is based upon grades for all probationary courses.

Following the attainment of satisfactory academic standing and removal from probation, a student who has failed a course during the two semesters preceding suspension and has repeated and passed such a course during the probationary period may retroactively invoke the provision which permits deletion of the course failure from the cumulative grade-point average.

### **Probationary Readmission**

A student who has been suspended from the University as a student in Continuing Education is entitled to apply for readmission as a probationary student but may not resume studies until after an absence from the University of one semester. Application for such readmission to all programs is made through the Office of Continuing Education in accordance with prescribed procedures and must be received by April 1 for readmission decision during the Fall Semester and by November 1 for readmis-

sion decision during the Spring Semester. Petitions which have been received by the filing deadline of November 1 will be reviewed by the Academic Standards Committee during the Fall Semester and readmitted students will be permitted to initiate their probationary studies at the beginning of the Spring Semester. Similarly, petitions which have been received by the filing deadline of April 1 will be reviewed by the Academic Standards Committee during the Spring Semester and readmitted students will be permitted to initiate their probationary studies at the beginning of the Fall Semester. The Academic Standards Committee may authorize a Continuing Education student to initiate probationary studies during the summer school if the student made such a request when filing an application for readmission.

In determining such requirements for probation, the Academic Standards Committee shall prescribe a sufficient number of courses (12 to 18 credits) which shall make the achievement of satisfactory academic standing reasonably possible during the designated probationary period. For complete information regarding Academic Standing, refer to the General Catalog of the University of Lowell.

**Warning:** Students who attend another institution while on suspension from the University must petition to have their courses accepted for transfer credit only after successful completion of the probationary period. Inasmuch as these courses would have been taken without permission of the curriculum coordinator, it is possible that such a petition could be denied.

### **Day School Students**

Day School students of the University of Lowell who are on academic suspension may not take courses through Continuing Education. Suspended students who wish to transfer to Continuing Education must consult with the Associate Director of Continuing Education prior to applying for readmission.

After securing recommendations from appropriate program coordinators and studying the previous academic record of the student, the Academic Standards Committee will set the conditions for probation (courses to be taken, conference schedules with the program coordinators, etc.). Since program transfer is permitted only for students in satisfactory standing, students who have been suspended for inadequate scholarship may apply for readmission as probationary students.

### **Administrative Dismissal**

A student may be dismissed from the University through cancellation of registration for due cause, through expulsion for academic dishonesty, and through disciplinary procedures for violations of good conduct.

### **Non-Academic Dismissal**

Dismissal may be invoked when a student fails to comply, after due notice, with an administrative requirement of the University. Administrative dismissal is noted on the permanent record card for each course registration by the symbol Y. An adminis-



tratively dismissed student who wishes to be reinstated must file an application for readmission with the Office of Continuing Education. Such reinstatement will be granted only if the condition which has necessitated administrative dismissal has been corrected to the satisfaction of University officials.

Examples of conditions which may justify administrative dismissal include: forgery or fraudulent use of University records, documents or forms (including unauthorized access to restricted computer files); non-payment of official University fiscal obligations and failure to comply with duly authorized administration order relating to the safety of persons or the protection of University property.

**Academic Dismissal**

Students who have evidenced academic dishonesty, including cheating and plagiarism, may be expelled from the University. University departments and colleges have established procedures for adjudicating charges of academic dishonesty and for establishing penalties up to and including administrative dismissal. Students expelled from the University for academic dishonesty shall fail those courses in which the dishonesty has taken place.

**General Academic Information**

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**Size of Class**

Courses are only offered if enrollment is sufficient. Thus, to ensure the scheduling of desired courses, students are urged to take advantage of the early registration policies as scheduled in each semester bulletin of class listings.

In the event that a course is cancelled, the Office of Continuing Education staff will try to notify preregistered students. Students may elect to substitute another course in its place or may request a full refund.

**Prerequisites**

Prerequisites indicate the course background expected of students and are listed for their benefit. Students should make certain that they have the necessary prerequisites for each course. Failure to consider prerequisites may result in being inadequately prepared to take the course.

**Class Standing**

Class standing is determined by a student’s total number of credit hours completed toward their degree program.

Freshman Standing	0-29 credit hours
Sophomore Standing	30-59 credit hours
Junior Standing	60-89 credit hours
Senior Standing	90 credits or more



## **Attendance**

Students must attend 80 percent of all classes held in their courses. More than three unexplained absences may cause a student to be dropped from the class enrollments with a grade of F in the course. Examinations or other work missed by absence may, at the option of the instructor, be made up or failed (except for provisions provided by absences due to religious reasons).

## **Class Schedule**

Classes in the Division of Continuing Education undergraduate degree programs are scheduled from 6:00 p.m. to 9:00 p.m. or 7:00 to 10:00 p.m. on Monday, Tuesday, Wednesday and Thursday evenings as listed in each semester tabloid. Saturday classes are also offered during the academic year.

Summer classes are scheduled two evenings a week; Monday and Wednesday, or Tuesday and Thursday from 7:00 p.m. to 10:00 p.m. Any other variations will be also stated in the bulletin.

## **Record Cards (Transcripts) and Reporting of Grades**

Grade reports are mailed by the Office of Continuing Education to the address listed on the student's registration form as soon as possible after the end of each semester.

**University policy does not allow grades to be given over the phone.** Students may file for official transcripts by completing the written form available in the Office of Continuing Education. All transcripts are \$1.00.

The University of Lowell will create and maintain a permanent record card (transcript) showing complete course and grade-earned information for any student, matriculated or non-matriculated, who takes a course for credit. This record may not be modified or selectively deleted for any reason including the student's lack of awareness of the drop and withdrawal deadlines cited in our semester bulletins.

## **Audit**

Credit may not be earned in courses that have been taken as an audit. Students who elect to audit a course may attend classes but are not permitted to take any tests or examinations or turn in any written assignment. No grade will be given and students will receive the notation AU on the transcript. Language, writing, laboratory or studio art courses cannot be taken for audit. The fee is one half the cost of credit tuition.

## **Student Health Insurance**

Effective September 1, 1989, every student who is enrolled in at least 9 credit hours or more per semester in a degree program is required by Massachusetts state legislature to participate in a qualifying student health insurance program. The cost of this insurance program is listed in each semester bulletin. To waive participation students must fill out a form at registration showing equivalent coverage. Name of the insurance company and policy number are required information on the waiver form.

### **Student Responsibility**

It is the student's responsibility to become familiar with all the regulations and procedures required by the academic program being pursued. In no case should students expect waiver or exception to published program requirements by pleading ignorance to the regulation or asserting that an advisor or other authority did not correctly present the information. All students are expected to become familiar with the academic information section of this catalog and the specific program requirements.

Students must pay for University equipment which they have broken or damaged, provided that such breakage does not occur while the student is under direct supervision of the instructor. In some instruction, students are required by law to wear safety glasses or other safety devices. The instructor of such classes will inform students of their obligation to obtain and wear the necessary safety protection.

### **Academic Integrity**

Students in the Division of Continuing Education are expected to be honest and to respect ethical standards in meeting their academic assignments and requirements. A student who cheats or plagiarizes on an examination or assignment is subject to administrative dismissal.



# Financial Assistance and Expenses

The opportunity for an education should not be determined by a person's economic status. As the cost of higher education increases, more students must depend on financial assistance to supplement their financial resources. The Division of Continuing Education is committed to providing access to financial assistance to students whose financial resources are limited. For most financial assistance, students must be matriculated in a degree or certificate program and enrolled in at least six credit hours each semester. For information regarding eligibility, contact the Office of Financial Aid or the Office of Continuing Education.

## **Commonwealth Employees Tuition Remission**

Certain collective bargaining agreements allow employees of the Commonwealth of Massachusetts, and, in some cases, their dependents, to take courses at a 50% reduction in tuition. Students who might be eligible for such a program should consult their personnel director for guidelines for proper enrollment criteria and procedures. Verification of eligibility on appropriate forms must be presented at the time of registration for classes.

## **Senior Citizens**

Senior Citizens are invited to register for academic courses. Continuing Education will waive all tuition for persons over the age of 60, subject to the availability of seats in the class.

## **Financial Aid Programs**

The financial aid available to eligible students at the University of Lowell includes the five major federal student assistance programs:

- Pell Grant (formerly the Basic Education Opportunity Grant)
- Supplemental Educational Opportunity Grant (SEOG)
- Perkins National Direct Student Loan (NDSL)
- College Work-Study Program (CWSP)
- Guaranteed Student Loan (GSL)

The Commonwealth of Massachusetts institutional financial assistance programs include:

- Massachusetts State Scholarship Program
- Board of Regents Tuition Remission Program
- Massachusetts Adult Learners Program
- Massachusetts Educational Employment Program
- Massachusetts Part-Time Student Grant Program

**Veteran and National Guard Benefits**

All students entitled to benefits under federal and state law must:

- 1. complete the application for admission form, and
- 2. declare a major program of study

in order to be eligible for these benefits. In addition, all veterans must submit a transcript of all post-secondary education or proof of a high school diploma or GED equivalency before registering in any program.

Veterans who are entitled to educational benefits under federal law and are attending the University for the first time must submit appropriate forms to the Office of Continuing Education. Forms are available in the Office of Continuing Education or the local Veterans’ Administration Office. Veterans who have not previously used benefits must also submit a DD214, and, if applicable, a marriage certificate and birth certificates of children.

Veterans who were in active service prior to May 5, 1975 and either entered from Massachusetts or can prove two consecutive years (minimum) residency are entitled to tuition exemption. To file, the student must submit with their registration either a Form 10 (available through the Department of Education - War Records) or a copy of DD214 and proof of residency.

The Army National Guard has a tuition assistance program (ACEA) that applies to Continuing Education. The program covers partial payment. Students must pay balance at time of registration. Eligible students must submit a DA2171 form with their registration. This form can be applied for through the unit commander’s office.

**Tuition and Fee Information**

Tuition is priced on the basis of credit hour unless contact hour is different. Tuition is then based on the listed contact hour. Tuition and fees are subject to change.

Registration *	\$15.00
Undergraduate Tuition (per credit/contact hour)	\$85.00
Graduate Tuition (per credit/contact hour)	\$115.00
Late Registration Fee *	\$10.00
Laboratory Fee *	\$25.00

\* Fees are not refunded unless Continuing Education is responsible for cancellations.

**Tuition Refund Schedule**

Refunds of tuition, if any, are made on the basis of the date and time of receipt of a student’s official withdrawal. Any eligibility for tuition refund is based on the academic calendar, not class attendance, and is prorated as follows:

Withdrawal before first class meeting	100%
Before the second class meeting	90%
Before the third class meeting	50%



**Late Fee**

A late registration fee of \$10.00 is charged to any student who registers after the regular registration period, which is published in each semester bulletin of course listings. This fee is assessed in addition to the usual registration fee and is nonrefundable.

**Payment of Bills**

All payments are due at the time students register for classes. A student who is in debt to the University at the end of any semester or summer session may not register for another term or receive transcripts or grade reports until the balance is paid. Registrations for such students may be cancelled without notice.



# Graduation

## **Graduation Interview**

Students anticipating graduation in the 1990-91 or 1991-92 academic years must arrange for a graduation interview through the Office of Continuing Education. The purpose of this interview is to determine eligibility for graduation and to begin the ordering process for the diploma. During this interview, degree candidates must correct such problems as missing courses, problems with grades, incompletes, transfer credit, etc.

Students who expect to complete their degree requirements in the fall semester must complete the interview by the end of October and students who expect to complete their degree requirements in the spring semester or summer terms must complete their interview by the end of the previous February. Students must complete these interviews by the specified deadlines published in the semester bulletins to ensure that their name is included in the graduation program and that their diploma is available at graduation time. Appointments are made in person at the Office of Continuing Education or by calling (508) 934-2480.

## **Commencement Fee**

A fee of \$75.00 is required of graduating students and is payable on or before registration for the final semester in which the student qualifies for the degree. The fee covers the cost of the student's eligibility review, the diploma, and the cap and gown for the graduation ceremony. All students are required to pay the graduation fee regardless of attendance at the graduation ceremony.

## **Awarding of Degrees**

The University awards degrees three times a year:

1. for students completing degree requirements during spring semester, the degrees are awarded in June and the diploma is available to students in June;
2. for students completing degree requirements during the fall semester, the degrees are awarded in February and diplomas available to students in March; and
3. for students completing degree requirements during the summer term, the degrees are awarded in October and diplomas available to students in December.

Individuals who wish to submit verification of degree completion to employers or to graduate schools during the period between the end of their final grading period and the conferring of degrees may obtain a letter of completion. Duplicate diplomas are not issued to students.

### **University Honors**

The University awards degrees with three levels of distinction upon those graduating students who have exhibited exceptional scholastic records. To graduate with honors a student must have achieved a minimum grade point average of 3.00 for all courses completed at the University, and must have earned a minimum of 60 semester credits at the University as upperclass students, or a minimum of 30 semester credits for the associate's degree. Additionally, students' cumulative average for both associate's and bachelors degrees must fall within the ranges set up by each college.

### **University Commencement**

Graduation exercises are held once a year in early June. Undergraduates who have completed requirements during the preceding fall semester, who complete degree requirements during the current spring semester, and who anticipate completion of degree requirements during the next immediate summer term are encouraged to attend commencement exercises and their names are listed in the commencement booklet.





# Student Services

The Division of Continuing Education offers academic counselling and career counselling to assist students in making educational and career choices. Academic advisors and career counselors are available for individual appointments. Continuing Education is sensitive to the concerns of the part-time student and encourages students to take advantage of the following services:

## **Academic Advising**

Students who choose to pursue a degree program are assigned an academic advisor. Early in their program of study students should arrange an appointment with the program advisor upon admission into a program. The advisor will outline a program of study, taking into consideration previous academic credit. Although the program advisor will assist students, each student must assume responsibility for observing the curriculum requirements and University policies.

New students, transfer students and students not enrolled in degree programs also may obtain academic advising on course selection and Continuing Education programs and policies. Academic advisors are available to talk to students about courses, transfer credit, degree requirements, and other matters of individual concern.

Students who have questions concerning career goals or who are uncertain about the choice of major are encouraged to meet with our career counselor to discuss these concerns.

Advisors are available Monday through Thursday between 9:00 a.m. and 8:00 p.m. and Friday 9:00 a.m. to 5:00 p.m. Students who want to consult a specific advisor should call ahead for an appointment. This service is located in the lower level of Cumnock Hall, North Campus. Individual appointments can be made by calling (508) 934-2480.

## **REAP: Returning to Education Adult Programs**

Each semester the Division of Continuing Education offers a program for students who are interested in returning to the academic environment. These classes will explore theories and strategies about how adults learn and adapt to college. Lectures on test-taking, note-taking and career decision-making skills will be offered. Computer skills will be introduced as an aid to educational learning. The program will familiarize students with the University of Lowell, the course registration process and how to matriculate for a degree program. Students will be given the opportunity to visit a class and talk with faculty about the University.

For interested participants, individual appointments will be arranged for assistance on career and academic planning. A nominal fee will be charged for this program.



## Career Placement

The services of the Placement Office, located in Southwick Hall, North Campus, are available to Continuing Education students during daytime hours. Services include interview and job marketing workshops, career days, and on-campus recruiting interviews. Students should refer to *The Connector* (day school newspaper) for weekly updates on placement services. For a copy of *The Connector* call the Office of Continuing Education.

## National Honor Society

The Gamma Delta Chapter of Alpha Sigma Lambda is a national honor society for adult students in Continuing Education. The aim of Alpha Sigma Lambda is to recognize adult students who achieve academic excellence in their course work while performing the many responsibilities associated with their families and careers. Eligibility for membership at the University of Lowell requires that students rank in the top 10% of all students who meet certain academic requirements. Selections for membership are made during each spring semester and students who are invited to become members are inducted into the Society in May. Membership in Alpha Sigma Lambda provides the University with an opportunity to acknowledge the endeavors of outstanding adult students in the Continuing Education program.



# University Policies

## **The Family Educational Rights and Privacy Act**

The Family Educational Rights and Privacy Act of 1974 (FERPA) assures confidentiality of educational records containing information directly related to a presently enrolled student, a former student or alumni. It also grants to any student currently in attendance, or to a former student, the right of access to inspect or review his or her educational files, records, or data. Students who wish to inspect their records must file a "Right of Access" form with the Office of Continuing Education. Within ten days of receipt of the right of access form, the Office will notify the student as to when and where the record may be inspected.

The University, according to FERPA, may make public "Directory Information" about a student (e.g., name, address, date and place of birth, telephone listings, schools attended, degrees and awards received, major field of study, participation in officially recognized activities and sports, and the most previous educational agency or institution). Students who wish to withhold directory information from public distribution must write to the Office of Continuing Education by October 1 of the academic year for which the information would be released.

Educational records concerning individual students may not be released to any individual or agency without written permission of the student; however, Chapter 776 of the Acts of 1975 specifies conditions under which records may be released without permission of the student. These conditions are listed in the University of Lowell Day School Bulletin.

## **Discrimination and/or Harassment**

Federal and state laws require that no student be discriminated against on the basis of age, national origin, race, religion, sex or handicap, marital, or veteran's status. The Affirmative Action Office, which implements Equal Opportunity/Affirmative Action, is located on the second floor of Dugan Hall (South Campus). The Affirmative Action Office deals with discrimination and harassment complaints and also with the monitoring of actual practice and written policies and procedures, (e.g.: student activities, course offerings, teacher and student attitudes). Sexual harassment of students by faculty, administrators, other employees, or fellow students is a form of sexual discrimination prohibited by Massachusetts Fair Practices Act, Title VII of the 1964 Civil Rights Act, and Title IX.

The University of Lowell will not tolerate behavior, either verbal or physical, by a member of the University community, which leads to sexual harassment of another member of the community. Any student who believes that he or she has been discriminated against or harassed, or who believes that the University is operating in a manner which adversely affects females, the handicapped, minority students or veterans should contact the Affirmative Action Office immediately.

**Absences Due to Religious Belief**

Any student who is unable, because of religious beliefs, to attend classes or to participate in any examination, study, or work requirement on a particular day shall be excused and shall be provided with an opportunity to make up the missed work, provided that such makeup does not create an unreasonable burden upon the school. No adverse or prejudicial results shall come to any student who invokes the provisions of this section of Massachusetts General Law (Chapter 151C, 2B).

**Hazing**

The organization of and participation in hazing is prohibited according to Chapter 536 of the Massachusetts Acts of 1985. Hazing means any conduct or method of initiation into any student organization which willfully or recklessly endangers the physical or mental health of any student or other person.

**Affirmative Action**

The University of Lowell is an Affirmative Action/Equal Opportunity University and does not discriminate on the basis of race, sex, or handicap status in its educational programs, activities, or employment programs, activities, or employment policies as required by Title IX of the Education Amendments of 1972 and Section 504 of the Rehabilitation Act of 1973 as amended.

**Policy Changes**

Although the Office of Continuing Education provides notice concerning changes as is reasonably practical under the circumstances, the University reserves the right to change requirements, subjects, courses, faculty listings, regulations and other policies stated in this document.

The University reserves the right to close a course registration, cancel a course, alter the scheduled time or faculty listing, change the scheduled night without formal notice, implement new rules and regulations and to make changes of any nature in its program, calendar, procedures and standards, and degree requirements.

The Office of Continuing Education periodically releases special announcements or changes from departments, colleges, and the University and, when feasible, directs instructors to read or distribute these in classes.

Administrative policies of a system-wide nature (e.g., admissions policies, tuition, and fees) are subject to change by the Board of Trustees of the University of Lowell and the Massachusetts Board of Regents of Higher Education without advanced notice.



# University Directory

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# Continuing Education Directory

## Administration

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Maxine E. Lentz Associate Director - Academic Affairs	B.S., M.A., Ph.D.
Dirk Messelaar Assistant Director - Special Programs	B.S., Ed.M., Ed.D.
Janet Sawyer Assistant Director - Administration and Finance	A.B., A.M.
Catherine A. Kendrick Publications and Promotions	B.A., M.A.
John Hurtado Conferences and Seminars	A. B.
Patricia A. Duff Community Education	B.S.
Pauline Carroll Academic Advisor	B.A., M.A.
Elizabeth A. Saucier Office Manager	

## Academic Operations

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Laura Edwards	
Ramona Gendron	
Aline Grimard	
Augurie Herring	
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## Business Office

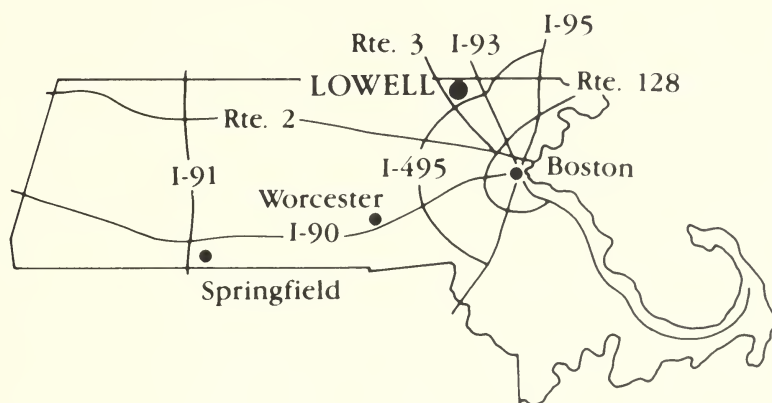
Pauline Allard
Elizabeth Wesson

**Academic Program Coordinators**

Donald R. Berry	A.B., M.A.	Liberal Arts, Criminal Justice
Majid Charmchi	B.S., M.S., Ph.D.	Mechanical Engineering Technology
Mukti L. Das	B.E., M.S., Ph.D.	Civil Engineering Technology
Alan W. Doerr	B.A., M.A.	Applied Mathematics
Stephen Driscoll	B.S., M.S.	Industrial Technology: Plastics Option
Ann Marie Hurley	B.S., M.S.	Computer Mathematics Option Information Systems
Philip S. Lamprey	B.S., Ph.D.	Applied Chemistry Applied Chemistry: Coatings Option
J. Robert Lemieux	B.S., M.S.	Electronic Engineering Technology
Richard Minesinger	B.S.E., M.B.A.	Industrial Technology: Manufacturing Option, Water/Wastewater Option
John Pignato	B.S., M.P.A., C.P.P.	Industrial Security Certificate Program
David Pullen	D. Phil.	Technical Physics
Bernard Shapiro	B.S., M.S.	Certificate of Computer Proficiency Minor in Applied Mathematics: Computer Option

**Evening Supervisors**

Alan W. Doerr	B.A., M.A.
Bernard Shapiro	B.S., M.S.



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